MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

Research and Development

Final Project Report

(Not to be used for LINK projects)

Date project completed: **25/01/2000**

Section 1 : Identification sheet

1. (a) MAFF Project Code: **OF 0154**

(b) Project Title: Production of organic seed for the organic farming sector.

(c) MAFF Project Officer:

(d) Name and address of contractor:

Postcode

(e) Contractor's Project Officer:

(f) Project start date: 04/01/1999 Project end date: 25/01/2000

(g) Final year costs:
- **approved** expenditure
- **actual** expenditure

(h) Total project costs / total staff input:
- **approved** project expenditure
- **actual** project expenditure
- ***approved** staff input
- ***actual** staff input

(i) Date report sent to MAFF:

(j) Is there any Intellectual Property arising from this project ?

***staff years of direct science effort**

Section 2 : Scientific objectives / Milestones

2. Please list the scientific objectives as set out in CSG 7 (ROAME B). If necessary these can be expressed in an abbreviated form. Indicate where amendments have been agreed with the MAFF Project Officer, giving the date of amendment.

1. Assess the current and potential availability of organic seed in the UK, elsewhere in Europe and from further afield.
2. Develop a forecast of demand for organic seed in the UK over the next 5 to 10 years.
3. Determine the obstacles that need to be overcome and whether or not they can be dealt with through UK or European co-operation.
4. Highlight problems that need further research input.
5. Produce a report covering the availability of organically produced crop seed for commercial organic use. This will include a list of seed companies and their organic seed products.
6. Organise a meeting to involve all of those with a major interest in the area including representation from seed producers and from growers. The meeting is to take place on Tuesday, 25 January 2000.

3. List the primary milestones for the final year.

It is the responsibility of the contractor to check fully that ALL primary milestones have been met and to provide a detailed explanation if this has not proved possible

Milestones		Target date	Milestones met?	
Number	Title		in full	on time

If any milestones have not been met in the final year, an explanation should be included in Section 5.

Section 3 : Declaration

4. I declare that the information I have given in this report is correct to the best of my knowledge and belief. I understand that the information contained in this form may be held on a computer system.

Signature _____ Date _____

Name _____

Position in Organistation _____

Section 4 : Executive summary

EXECUTIVE SUMMARY

Under the European Union Regulation on the organic production of agricultural products (2092/91) crops raised in organic systems should be grown from organically produced seed or vegetative material. However, the supply of organic seed is limited in the UK and in Europe as a whole and so by way of derogation, the EU Regulation permits the use of untreated, conventional seed on organic farms only when an appropriate organic variety can not be sourced. At the start of this project, the derogation period was due to end on 31 December 2000; however, it was extended in June 1999 to 31 December 2003, after which the use of conventional seed will not be permitted on organic farms. In order to evaluate the current situation regarding organic seed availability, future demand for seed and the problems restricting the development of an active organic seed production industry in the UK, the following tasks were undertaken with the aim of helping to facilitate the commercial use of organic seed and contributing to the ending of the use of conventional seed on organic farming systems.

Objectives

1. Assess the current and potential availability of organic seed, in the UK, elsewhere in Europe and further afield.

2. Develop a forecast of demand for organic seed in the UK over the next 5-10 years.

3. Determine the obstacles that need to be overcome and whether or not they can be dealt with through UK or European co-operation.

4. Highlight problems that need further research input.

5. Produce a report covering the availability of organically produced seed for commercial organic use, including details of species and varieties where further work is needed and recommendations for future actions.

Results

- There are 251 different varieties of organic seed commercially available to UK organic farmers and growers, 98% of which are vegetable varieties and 1% are cereal varieties. There are no grasses or herbage legumes available. Of the major crops, only 4% of the varieties most commonly used by UK organic producers are currently available as organic seed.

- The survey undertaken to assess the availability of organic seed in Europe and further afield had a very poor response and so little information was collected. From those organisations that did reply (11% of the total), the general view was that organic seed was in short supply in Europe.

- Based on 1997 data, demand for organic cereal seed is likely to double, demand for vegetable seed will triple, and demand for grassland seed will increase 7 or 8 times. With the current trend in organic seed production, these demands will not be met at the end of the derogation period unless a massive increase in production takes place.

- The problems associated with organic seed production expressed by fourteen seed companies in the UK could be broadly placed within three categories: 1) Marketing, 2) Technical and 3) Standards. Many of the problems were only perceived problems (not actual ones) that could be overcome through education, training and discussion.

- This study has shown that organic seed production must go ahead and that there are no real obstacles to cause delay.

- Areas where further work is necessary have been identified and recommendations for future actions have been made.

Comments and recommendations for future actions

1. Press ahead with organic seed production.

2. More rigorous policing of the current derogation is required.

3. Make a rapid commitment not to extend the current derogation.

4. Major improvements are required in organic variety testing to identify which varieties should be produced as organic seed.

5. Further work is required on pest, disease and weed problems specifically related to organic seed production.

6. Research is required on the standards of other European countries and third countries.

7. MAFF census data should include organic agriculture and horticulture information.

Section 5 : Scientific report

1 INTRODUCTION

The European Union Regulation on the organic production of agricultural products (2092/91) states that crops raised in organic systems should be grown from organic seed. This is defined as seed produced from parent plants that have been grown organically for at least one generation. However, the supply of organic seed is limited in the UK because the seed industry has chosen not to expand the commercial production of organic seed. At present, if organic farmers or growers cannot source organic seed for a particular crop, they are allowed to use untreated conventionally produced seed in its place. However, this means that organic production relies on the use of conventionally grown seed, a situation that has long been viewed by the organic movement as inappropriate. For example, organic producers risk undermining the growing support from the general public who may see the use of conventional seed as a loophole in the integrity of organic production. Moreover, conventional seed production may soon be dominated by the use of genetic engineering technology, which may mean that consumers will only be able to buy food in which this technology, or derivatives of it, has been used. Organically produced food can offer a choice for consumers concerned about genetic engineering technology only if organic farming stops using conventional seed and uses seed that has been produced by organic methods. Despite these issues, little has been done to improve the scale of production of organic seed in the UK.

At the start of this project there was an urgent need for change because the derogation period for using conventional seed on organic systems was due to end on 31 December 2000 (EU 2092/91), after which all seed used on organic farms must have been organically produced. However, in June 1999 this derogation period was extended to 31 December 2003. It is particularly important not to allow complacency to dominate during the derogation period. Therefore it is necessary to stimulate the production of organic seed in the UK and Europe so that current needs can be met and also to make provision for the expansion of the organic sector.

The aim of this study was to provide information regarding organic seed production by carrying out the following tasks:

1. Assess the current and potential availability of organic seed, in the UK, elsewhere in Europe and from further afield. This will include consideration of possible quarantine problems and of the health and quality of seed from different sources.
2. Develop a forecast of demand for organic seed in the UK over the next 5-10 years, based on European survey and modelling data and UK producer requirements. An outline forecast should also be derived for the EU as a whole.
3. Determine obstacles that need to be overcome and whether or not they can be dealt with through UK or European co-operation.
4. Highlight problems that need further research input with emphasis on the following areas: seed production methods, seed quality, seed treatment for disease and pest control: availability and use of physical and biological controls, carryover of unwanted seed, seed longevity and stock maintenance.
5. Produce a report covering the availability of organically produced crop seed for commercial organic use, including details of species and varieties where further work is needed and recommendations for action in those cases. A list of seed companies and their organic seed products, both in the UK and the EU generally, would be included.

A meeting is also due to be held at Noble House, London on 25 January 2000 to disseminate the information presented in this report.

2 CURRENT AVAILABILITY OF ORGANIC SEED IN THE UK

The current and potential availability of organic seed in the UK was assessed by contacting major seed companies and asking whether they produced or supplied organically produced seed. Information regarding organic seed available for 1999/2000 was collated, and a list of seed and sources was compiled (Annex 1). This list is not exhaustive and the information supplied by the seed companies was taken on good faith that it was correct and that the seed was both available and organically produced.

The number of organic crop varieties available for 1999 to 2000 was compared with an estimate of the number of varieties requested by organic farmers and growers in 1998 under the derogation for the use of conventional seed. These requests indicate the types of varieties organic producers cannot obtain as organic seed and were intended to be used to compare the level of demand for seed in terms of numbers of varieties, with the current supply situation of organic seed. This information was obtained from the United Kingdom Register of Organic Foods (UKROFS) and comprised data from the Soil Association, Organic Farmers and Growers Ltd., the Organic Food Federation and the Scottish Organic Producers Association. Information from the Biodynamic Agricultural Association and the Irish Organic Farmers and Growers Association was not supplied by UKROFS. The number of farmers and growers who returned derogation request forms to the sector bodies is approximately 302. This number represents only 21% of licensed organic producers in 1998 which indicates that the information used is not necessarily representative of the majority of UK organic producers. More importantly, it also means that one of two situations applies; 1) that 79% of organic farmers in the UK in 1998 were fully using organic seed; 2) that 79% of organic farmers in the UK were not filling in derogation request forms for the use of conventional seed in 1998. From what is known about the lack of availability of organic seed in the UK and Europe, it would have been impossible for 79% of organic producers to be fully using organic seed in 1998 which means that they were using conventional seed without seeking permission from the relevant sector bodies. Moreover, this also indicates that the sector bodies were not adequately policing the derogation as they are required to do according to the EU Regulation (2092/91) and UKROFS standards. The UKROFS standards state that under the derogation “seeds or vegetative propagating material not obtained from organic production may be used with the approval of UKROFS. Users through their Approved Body will need to satisfy UKROFS that they were unable to obtain on the Community market, suitable propagating material for an appropriate variety of the species in question”. It is obvious that this procedure is not taking place because UKROFS only has records of requests for seed under the derogation of only 21% of

producers during 1998. It is the responsibility of the sector bodies to inform UKROFS of the use of conventional seed on their licensees' land to obtain approval, however, the sector bodies seem to be unaware of whether or not the vast majority of their licensees are using conventional seed. This contravenes the EU Regulation (2092/91) and is likely to inhibit the development of an organic seed industry if it continues.

The list of available organic seed (Annex 1) comprises 251 different varieties that are supplied by seven seed companies, five of which are UK based but who source overseas supplies of organic seed and only two that produce and supply organic seed in the UK. This list is not exhaustive especially in terms of information regarding the availability of seed in Europe and further afield. The lack of information regarding seed availability in Europe and the rest of the world was largely due to an exceptionally poor response in an extensive e-mail survey that was carried out. Therefore further sources of organic seed from abroad may be available to UK organic farmers and growers which are not listed in this report.

Of the 251 varieties listed as commercially available organic seed, 245 (98%) were vegetable varieties, 3 (1%) were cereals and there were no grass or herbage crops. From the total number of varieties, 25% were varieties of lettuce, 11% were varieties of potato and 8% were varieties of bean.

Table 1 shows information from a selection of the major crops and Table 1a provides a summary of Table 1. It can be seen that of the number of varieties of major crops of cereals, salad/protected varieties, vegetables and grasses/herbage legumes commonly used on organic farms as indicated by derogation requests, the number of varieties commercially available as organic seed is only 5%, 29% 9% and 0% of that number. Moreover, not all of the varieties that are available as organic seed, are the types of varieties requested by UK farmers and growers. In the case of salad/protected crops and vegetables, only 11% of the varieties requested were available as organic seed and for cereal only 5% (Table 1a). The crop that shows the best complement between supply and demand is potatoes in which 29% of the varieties that were requested under the derogation are also available as organic seed. Conversely this means that at least 71% of the varieties commonly used are not available for all of the major crops listed in Table 1.

Table 1a. Summary of Table 1; The figures in parentheses denote the number of common varieties requested and available presented as a percentage of the number of varieties requested for each crop.

Crops	Number of varieties requested under the derogation	Number of varieties available for 1999 and/or 2000 from EFRC list	Number of overlapping varieties from the EFRC list
Cereals	62	3	3 (5%)
Salad/protected crops	371	107	26 (7%)
Vegetables	1227	112	44 (4%)
Grasses & herbage legumes	102	0	0 (0%)
Total	**1762**	**222**	**73 (4%)**

These data do not take into account the amounts of seed required by farmers and growers but focus only on the number of varieties requested and available for use. Table 1 shows that a large number of varieties are used by organic farmers for the crops listed and suggests that a great deal of biodiversity is maintained on organic farms. Biodiversity is an important factor in organic agriculture and maintaining genetic diversity within the agricultural system is one of the principles of the International Federation of Organic Agriculture Movements (IFOAM). If the current availability of organic seed does not change by the end of the derogation period for use of conventional seed (31 December 2003), this would mean a dramatic reduction in the number of varieties that can be used by organic producers, which is likely to be detrimental to organic systems. Large commercial farmers and growers in the UK usually rely on only a few varieties of crops for production and so a reduction in the number of varieties available as organic seed is less likely to affect them. However, small scale organic producers are likely to be greatly restricted. For most of the major crops, the varieties that are available as organic seed are not necessarily the ones that are commonly used in the UK. This could mean that farmers and growers may have to resort to using varieties with which they are not familiar, or which are not suitable for UK or regional conditions. This may mean the reduction of yields in some cases.

Table 1 shows that there is a general shortage of organic seed for most crops, but the main shortages must be defined as those crops that have no organically produced varieties commercially available. These crops include; oats, rye, triticale, parsnips, swedes, turnips and grasses and clovers. In addition to these species, those that have varieties available which do not include any of the varieties commonly used in the UK could also be defined as in very short supply. These include: brussels sprouts, cabbage, cauliflower, celery, courgettes, kale, kohl rabi, spinach, sweetcorn and tomatoes. In one respect, any one of the major crops in Table 1 could be concentrated upon with respect to increasing the number of organic varieties available because the availability of seed is generally so low. In another respect, one of the major crops to be focused upon should be red clover and other nitrogen-fixing herbage due to the reliance of the organic system on soil-fertility building leys.

2.1 Action taken in the UK regarding organic seed

The Ministry of Agriculture Fisheries and Food (MAFF) was not in favour of the recent extension of the derogation because it was felt that it would discourage seed companies from developing organic seed and disadvantage those producers who had prepared themselves for the previous deadline of 31 December 2000. MAFF has funded research and development work examining the organic seed issue to stimulate the seed industry to become involved in organic seed production. The current study, undertaken at Elm Farm Research Centre, is part of that research and development effort. Another MAFF-funded project is currently looking at the economic

and agronomic feasibility of vegetable seed production in the UK, and subsequent seed quality. This project is lead by Horticulture Research International, UK and the main part of this study comprises trials of organic seed production under protected structures using a small number of species as model crops. Subsequent testing of the seed produced will be undertaken to assess quality of the seed. The major aim of this project is to provide technical and economic information on organic seed production in the UK. This project is in its first year of operation and is due to run for 5 years and EFRC and the Henry Doubleday Research Association are sub contractors to this programme.

Table 1. Numbers of varieties of major crop types that were requested by organic farmers and growers under the derogation for use of conventional seed, compared with the number of varieties of these crops available as listed in Annex 1. The figures in parentheses denote the number of common varieties requested and available presented as a percentage of the number of varieties requested for each crop. ND = No data.

Crops	Number of varieties requested under the derogation	Number of varieties available for 1999 and/or 2000 from EFRC list	Number of overlapping varieties from the EFRC list	
Cereals				
Barley	13	2	2	(15%)
Oats	12	0	0	
Rye	4	0	0	
Triticale	5	0	0	
Wheat	28	1	1	(4%)
Total	**62**	**3**	**3**	**(5%)**
Salad/protected crops				
Celery	16	4	0	
Cucumber	43	14	1	(2%)
Endive	25	14	3	(12%)
Lettuce	*145	62	*20	(14%)
Peppers	55	3	2	(4%)
Tomato	87	10	0	
Total	**371**	**107**	**26**	**(7%)**
Vegetables				
Beans	*117	20	*4	(3%)
Beetroot	42	4	1	(2%)
Broccoli	41	1	ND	
Brussels sprouts	36	1	0	
Cabbage	180	3	0	
Carrots	73	7	3	(4%)
Cauliflower	99	3	0	
Celeriac	7	3	1	(14%)
Courgette	34	1	0	
Kale	33	2	0	
Kohl Rabi	9	2	0	
Leeks	70	4	3	(4%)
Onions	65	1	1	(2%)
Parsnips	16	0	0	
Peas	*55	7	*3	(5%)
Potatoes	84	28	24	(29%)
Pumpkin (Squash)	108	5	1	(1%)
Radish	37	8	2	(5%)
Spinach	29	9	1	(3%)
Swedes	16	0	0	
Sweetcorn	50	3	0	
Turnip	26	0	0	
Total	**1227**	**112**	**44**	**(4%)**
Grasses & herbage legumes				
Cocksfoot	*2	0	0	
Italian ryegrass	*12	0	0	
Perennial ryegrass	*46	0	0	
Red clover	*12	0	0	
Timothy	*7	0	0	
White clover	*23	0	0	
Total	**102**	**0**	**0**	**(0%)**
Grand Total	**1762**	**222**	**73**	**(4%)**

***These figures are approximate because some of the derogation requests did not specify varieties, only types of crops like perennial ryegrass or cos lettuce.**

The Soil Association has also set up an Organic Seed Working Group that had its first two meetings in April and November 1999. The working group comprises seed companies, organic farmers/growers, and members of various research bodies and aims to discuss the technical challenges and concerns surrounding organic seed production in general, and for specific crops in order to support a developing organic seed industry in the UK. A total of five meetings is planned over the next two years (until the end of 2000), sponsored by MAFF and members of the conventional seed industry.

3 CURRENT AVAILABILITY OF ORGANIC SEED IN EUROPE AND FURTHER AFIELD

An e-mail survey to assess the availability of organic seed in Europe and further afield was undertaken in which 53 organisations were contacted from 28 different countries. Most of the organisations contacted were obtained from the IFOAM Directory or from contacts given by UKROFS. A list of these organisations, and the questions asked in the survey, can be seen in Annex 2.

The response rate was very poor with only seven useful replies, which accounts for 13% of the total contacts made. All of the replies were from European countries and mainly from government departments. The information they supplied is as follows:

3.1 Sweden

Information from the Swedish Board of Agriculture confirms that there is a shortage of organic seed in Sweden and for many crops there is no organic seed available at all. However, the production of organic seed is growing slowly and in 1999 there has been organic seed for some species of cereals, peas, potatoes and horticultural crops, available on the Swedish market.

In Sweden, the Swedish Board of Agriculture issues the regulations concerning organic seed and organic seed has to be used on organic farms, if available. Before every growing season, the Board of Agriculture identifies which species and varieties the farmers must use organic seed. This system is based on information from the seed companies about available organic seed quantities on the Swedish market. If the seed for a certain variety or species runs out during the growing season, a general authorisation is granted allowing conventional untreated seed to be used. The two approved sector bodies in Sweden make sure that these regulations are followed.

The official view in Sweden regarding the derogation period is that the time should be used to increase supplies of organic seed but that enough seed might only be available for some crops and not for all by the end of the period. As long as the market for organic seed is small, there will probably be only a few varieties of each species available as organic seed. There is a risk that the organic farmers may have to use varieties that are not specialised for their region and cultivation conditions.

The opinion of the Swedish Board of Agriculture is that there is a need for a review of the provisions made by the European Commission earlier than proposed (31 December 2002) if all seed in organic farming should be organic by 1 January 2004. They think that it is more important to make sure that the seed is not chemically treated than that it is produced with organic methods. The opinion of the Board is that the provisions of organic seed will not be sustainable until the organic farming sector has grown.

3.2 Ireland

Information from the Department of Agriculture and Food in Ireland reported that there is no organic seed production in Ireland other than where some organic cereal and potato growers save seed for use in the following year. The organic certification and inspection bodies in Ireland try to insist that their members use organic seed where supplies are available but many producers have to take advantage of the existing derogation under EU Regulation 2092/91 due to short supplies.

The Department of Agriculture and Food, together with the private sector bodies were very concerned about the supply of organic seed in light of the initial end of the derogation period that was due on 31 December 2000. They were preparing a submission for the European Commission requesting an extension to the derogation for a further 5 years. Therefore, the recent extension to 31 December 2003 was favoured by the Department of Agriculture which now hopes that great progress will be made in the intervening period in the production of organic seed in the EU.

The Department states that as the total area devoted to organic production in Ireland is yet very small, and of that area a large proportion is under grassland, so the economic viability of any seed production would be doubtful in Ireland. As a consequence, Ireland is likely to be dependent on other EU countries for organic seed for some years.

At present, seed from cereals, potatoes and grasses are the only seed being produced under the Department of Agriculture and Food Seed Certification Schemes. These seed production schemes are quite successful using modern methods of crop production. The Department feels that the success of such seed production schemes within the Irish climate without the use of chemical fertilisers, weed control, fungicides and pesticide is something that would need a great deal of research.

3.3 Austria

The Ministry of Agriculture and Forestry in Austria gave its view that there is a shortage of certain organic seeds, in particular vegetable and maize seeds but generally other species are available in Austria. The inspection bodies are given the right to allow conventional, undressed seed to be used on organic farms especially if vegetable or maize seed are required. Austria is actively trying to promote organic seed production and use the derogation period to reach the goal of providing the whole of the Austrian market with organic seed. For this reason the Ministry of Agriculture and Forestry welcomed the recent extension to the derogation period.

3.4 Finland

Information from the Department of Plant Production at the University of Helsinki reported that in Finland there are likely to be few problems in obtaining organic cereal seeds but vegetable seeds are harder to source because there is no vegetable seed production (neither conventional or organic) in Finland. The Department's view is that at the end of the derogation period Finnish vegetable growers will have to rely on the same seed producers abroad as they do at present because they will need the best varieties suited to Finland. This means therefore, that they will have to rely on those seed companies to produce those varieties organically. In addition, information from the Ministry of Agriculture and Forestry in Finland states that they have funded a research programme into the development of production for high quality seed. Moreover, there is also ongoing research being undertaken on the availability of organic seed in Finland. However, although action is being taken to improve the availability of organic seed, the Ministry was in favour of the extension to the derogation.

3.5 Norway

Norway belongs to the collection of countries in the European Free Trade Association (EFTA) and the European Economic Area (EEA). All EFTA-EEA countries are obliged to implement the EU regulation for organic farming and have to fulfil the same criteria as the fifteen member states. Therefore, in terms of organic farming, Norway is not considered a third country.

The Norwegian Agricultural Inspection Service reported that there is a shortage of organic seed in Norway but they do have some varieties of pasture seeds and of swedes. Some organic seed is imported from Sweden but many of their organic producers use untreated conventional seed under the current derogation. There are projects being undertaken to increase organic seed production in Norway and they welcomed the extension to the derogation because of this. The Norwegian Agricultural Inspection Service views the prospect of providing organic seed to their organic producers as achievable by 2004 because only 2% of the agricultural land in Norway is organic and the market is still small. Their main concern is being able to build up a production system that will allow organic producers choice of varieties because they feel this may be lacking initially.

3.7 The Netherlands

The Ministerie van Landbouw stated that currently The Netherlands is developing a new plan of action for organic farming which will be presented to the Dutch parliament in spring 2000. An important part of this will be a plan of action for organic plant breeding and seed multiplication which was specifically requested by the Dutch Parliament. Moreover, the very large plant breeding industry in The Netherlands is very interested in taking up organic plant breeding. So far, the Ministerie has already initiated discussions on the definition of organic plant breeding, as it is not defined in the EU Regulation for organic farming.

The extension of the derogation period to the end of 2003 was positively received by both the organic sector and plant breeders in The Netherlands; however, it is explicitly felt that if further extensions are to be prevented, more action is required to promote organic seed production.

3.8 Comment

The level of response in this survey was very disappointing and shows a general reticence from the major organic agriculture organisations throughout the world. It may be judged from the lack of response that, other countries do not view organic seed as an important issue for organic farming. If this is the case, then it is unlikely that they are actively promoting organic seed production or use within their respective countries. For example, the regulation in North America is considerably looser that that adopted in Europe (J. Cherfas, pers.comm., see Annex 3). This would then put those countries who are conforming to the EU Regulation and those outside the EU who want organic seed to be used, at a disadvantage because of the limited availability and relatively high cost of organic seed.

From the few responses given in the survey, the situation of organic seed supply seems to be one of shortage. Many of the government departments that replied, welcomed the derogation extension and viewed it as an opportunity for organic seed production to increase. However, without active encouragement, the seed industries in these respective countries may not use this time to develop organically produced varieties if the market is considered to be too small. This was an issue touched upon by the Swedish Board of Agriculture.

In Finland and Ireland, it would seem that they are relying on other European countries to develop organic varieties for them to use. However, if organic seed production is in short supply within many European countries, much organic seed will be consumed by the home markets initially. As in conventional seed production, it is likely that organic seed production centres will develop in areas such as The Netherlands, France, Italy, Spain and Germany where much of the conventional seed production occurs. The plant breeding industry in The Netherlands has already expressed an interest in breeding plants by organic methods. Other European countries may be able to tap a supply of organic seed from such areas once organic seed production has grown and individual seed companies or collectives realise that there is a Europe-wide market. However, this may lead to uniform organic varieties being used across organic farms in Europe which would compromise the ideal regarding biodiversity within organic systems. Moreover, the varieties that may be imported may not be of a type most suitable for a particular country or region. There may also be a need for a system to be set up to guarantee the 'organic authenticity' of seed especially from countries that are not covered by the EU legislation. This would allow the importer assurance that suitable standards were upheld during organic seed production.

3.9 Seed movement between countries

There is a well structured and rigid system in place, regarding the importation of seed and plant material into Europe. This is to restrict the spread of pests and diseases that may be carried into a country by imported plant material, so potential quarantine

problems should not be an issue for the importation of organic seed. Restrictions for the importation of seed from third countries (all countries outside the fifteen EC member states) are laid down in EC legislation and implemented by the Plant Health (Great Britain) Order of 1993. Certain plants and plant products are prohibited from entering UK and other countries from third countries but those that are not, must be accompanied by a phytosanitary certificate if coming from a third country. This statement ensures:

- that the material has been officially inspected in the country of origin (or despatch)
- compliance with statutory requirements for entry into the EC
- that the material is free from quarantine pests and diseases and substantially free from other organisms.

It may be possible to import prohibited material for trials or scientific purposes or for work on varietal selections but only under a licence issued by the appropriate authorities (MAFF, 1998).

The movement of plants and plant products in the fifteen EC countries is largely unrestricted but a limited range of materials which may host quarantine pests and diseases requires a plant passport. Plant passports are essentially a guarantee that plants are free of pests and diseases. The passport guarantees that:

- the plant material has been grown by a registered producer, whose premises are regularly inspected and who is authorised to issue plant passports.
- the plant material is free from quarantine pests and diseases and grown in an environment free from these (to the producer's best knowledge).
- plants imported from outside the EC have been landed by a registered importer, inspected on arrival in the EC and found to be free from quarantine pests and diseases (MAFF, 1995).

Protected zone passports are required if plants prone to certain pests/diseases are moved to a designated protected zone that does not have such pests/diseases (e.g. the UK is free of Colorado Beetle which is well established in some other EC countries so the UK has Protected Zone Status for Colorado Beetle). The protected zone passports guarantee that the plants are free from the particular pests and diseases (MAFF, 1995).

Seed potatoes require plant passports at every stage of the trade chain in any EC country even if the potatoes are moved from the farm to a packing station off the farm. Other seeds that require plant passports when sold or moved for commercial growing on to other EC countries are shallots, onions and chives (all as seeds or of bulbs), and leeks either as plants or seeds (MAFF, 1995).

The regulations within EC member states will not safeguard the health of much of the seed that may be moved between them because most plant products do not need plant passports. It would be the responsibility of those who buy the seed from abroad to insist that seed producers provide information on the level of disease content within the seed or to test the seed themselves for disease if they are concerned. Seed being marketed in the UK is subject to regulations requiring certain standards of purity and germination for certified seed. Some other countries within the EC have similar systems comparable with that of the UK which allows them to market their seed in the UK (C. Skelton, pers. comm.).

The EU Regulation for organic agriculture (2092/91) also provides rules and restrictions on the importation of organic plant products from third countries. This mainly comprises issues such as labelling, packaging storage and inspection of products.

4 FUTURE PROJECTIONS OF THE DEMAND FOR ORGANIC SEED

4.1 Introduction

The potential demand for organic seed by the organic farming sector is an important factor to consider for both seed companies and other organisations interested in organic seed production. By knowing the current demand and how it is likely to grow, seed producers can gauge the market and develop production strategies around market information. However, the difficulty in constructing such a forecast is that there is little current published data to use. At the time of writing this report, the most recent published data regarding organic crop area and production for specific crops was for 1997 (Soil Association, 1998). Moreover, the most current published data on the growth of the area of land under certain organic crops and land uses, is also for the period between 1993 and 1997 (Foster & Lampkin, forthcoming). These sources of data were used as a baseline for the forecast compiled in this study and information regarding seed rate and yields were taken from both organic sources (Lampkin & Measures, 1999 & the Organic Conversion Information Service, EFRC) and conventional sources (seed industry and Faulkner, undated). A description of the information and assumptions used is given in Annex 4.

Estimates of the growth rates of production land under various organic crops were calculated from data from Foster & Lampkin (forthcoming) which was collected from national agricultural administrations and certification bodies and can be seen in Figure 1. The mean growth rate between 1993 and 1997 was calculated by taking the average of the growth rates between successive years.

The subsequent mean growth rates were therefore 17.8% per year for cereal land, 26.5% per year for vegetable land and 50% per year for grassland. These calculated growth rates assume an entirely linear growth in organic production land which is not the case in reality, as can be seen from figure 1. Using these calculated growth rates, the land under various crops was calculated by increasing the land area given in 1997 by the mean growth rate for subsequent years.

Estimates of seed uses and the area of land required to produce the seed were made for 1997. Projections of the seed requirements and seed production land areas were then taken from the 1997 datum and made for 2002 and 2005. It was considered that providing

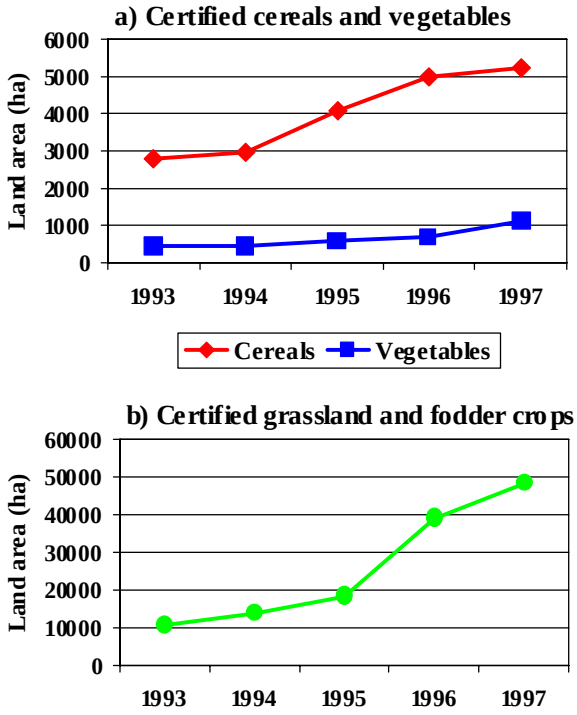

Figure 1. a) The growth in land area of organically certified cereals, vegetables and b) grassland and fodder crops in the UK between 1993 and 1997. Data taken from Foster and Lampkin (forthcoming) from which the average growth rate figures for the forecast were calculated.

Table 2. Approximate organic seed requirements by organic producers in the UK for 1997, 2002 & 2005. The 2005 data is presented in italics as an indication that these figures in particular should be viewed with caution. A description of the calculations is given in Annex 4.

		Approximate amount of organic seed required in the UK (tonnes)		
		1997	**2002**	***2005***
Cereal crops	Barley	96	217	*355*
	Oats	261	592	*967*
	Rye	27	62	*101*
	Spelt	16	35	*58*
	Triticale	44	100	*163*
	Wheat	695	1,577	*2,578*
	Total	**1,139**	**2,583**	***4,222***
Vegetable crops	Beans	2.102	6.810	*13.785*
	Beetroot	0.175	0.567	*1.148*
	Broccoli	0.010	0.032	*0.066*
	Cabbage	1.236	4.002	*8.102*
	Carrots	0.133	0.432	*0.874*
	Onions	0.173	0.561	*1.135*
	Leeks	0.071	0.229	*0.463*
	Parsnips	0.027	0.087	*0.176*
	Peas	2.143	6.941	*14.051*
	Swede	0.160	0.518	*1.049*
	Total	**6.230**	**20.179**	***40.849***
Potatoes	**Total**	**2,093**	**6,780**	***13,725***
Grassland crops	Cocksfoot	12	91	*306*
	Italian ryegrass	32	246	*832*
	Lucerne	43	329	*1,109*
	Meadow fescue	22	165	*555*
	Perennial ryegrass	374	2,839	*9,581*
	Red clover	22	164	*555*
	Sainfoin	134	1,019	*3,438*
	Timothy	111	840	*2,836*
	White clover	73	557	*1,879*
	Total	**823**	**6,250**	***21,091***

forecasts of demand beyond 2005 would result in erroneous and misleading information because it would stretch the 1997 data too far. These estimated forecasts are given in Tables 2 & 3. This forecast is based on the assumption that the tastes and habits of the farmers, retailers and consumers will not change over the near future and that the growth of organic farming will remain the same as the average, linear growth rate between 1993 and 1997. It is therefore likely that some of the figures presented here are under-estimates especially for the vegetable crops. However, it should be noted that the figures for the demand of grassland seed are very

large compared with the current requirement which is approximately 15,000 to 18,000 tonnes for agricultural seed mixtures in the UK (MAFF, 1999).

4.2 Comment

The forecast figures show that the demand for cereal seed on organic farms is likely to almost double in 2002 compared with the calculated demand for 1997 and that the vegetable seed demand is likely to more than triple in the same period. Moreover, the demand for grassland seed during this period is likely to be 7 to 8 times greater in 2002 compared with 1997. By the end of 2003 (the end of the derogation period) the seed requirements for these crops will be greater than those calculated for 2002 and from this point, all seed used on organic farms will have to be organically produced. However, unless a dramatic increase in organic seed production takes place, this level of demand will not be met by the end of the derogation period.

Table 3. Approximate areas of organic land needed to produce the organic seed requirements (given in Table 2) in the UK for 1997, 2002 & 2005. The 2005 data is presented in italics as an indication that these figures in particular should be viewed with caution. A description of the calculations is given in Annex 4.

		Approximate amount of organic land required for seed production in the UK (ha)		
		1997	**2002**	***2005***
Cereal crops	Barley	26	58	*95*
	Oats	64	146	*239*
	Rye	7	16	*26*
	Spelt	4	9	*15*
	Triticale	10	23	*38*
	Wheat	174	394	*645*
	Total	**285**	**646**	***1,058***
Vegetable crops	Beans	0.530	1.718	*3.477*
	Beetroot	0.127	0.412	*0.835*
	Broccoli	0.004	0.013	*0.027*
	Cabbage	1.675	5.427	*10.985*
	Carrots	0.267	0.864	*1.749*
	Onions	0.446	1.445	*2.925*
	Leeks	0.115	0.373	*0.755*
	Parsnips	0.015	0.050	*0.100*
	Peas	0.100	0.325	*0.658*
	Swede	0.976	3.162	*6.400*
	Total	**4.255**	**13.789**	***27.911***
Potatoes	**Total**	**95.13**	**308.2**	***623.8***
Grassland crops	Cocksfoot	16	121	*408*
	Italian ryegrass	30	224	*756*
	Lucerne	82	626	*2,113*
	Meadow fescue	42	316	*1,066*
	Perennial ryegrass	340	2,581	*8,710*
	Red clover	51	387	*1,305*
	Sainfoin	244	1,852	*6,252*
	Timothy	243	1,846	*6,229*
	White clover	489	3,711	*12,525*
	Total	**1,537**	**11,664**	***39,364***

5 PERCEIVED PROBLEMS AND OBSTACLES ASSOCIATED WITH ORGANIC SEED PRODUCTION

A survey was undertaken to determine any obstacles or perceived problems associated with organic seed production that need to be overcome in order to encourage more production. Information via structured interviews was collected from fourteen seed companies based in the UK mainly comprising conventional seed producers/suppliers but also including one organic seed producer. The companies that were contacted comprised those that had previously expressed an interest in organic seed production by taking part in a preliminary meeting to discuss organic seed. Six of the seed companies comprising both agricultural and horticultural seed traders were visited in person. The remainder were contacted by telephone. Furthermore, two organic research institutes and one commercial organic seed company were also visited in Germany and the Netherlands to obtain views from the European perspective of organic seed production and associated research work that has been undertaken. Both a list of those organisations contacted, and a list of questions asked can be seen in Annex 5.

Figure 2 shows the most commonly perceived problems associated with organic seed production as expressed by the fourteen UK seed producers/suppliers interviewed. Of these fourteen companies, five were vegetable seed companies and nine were agricultural seed companies. The problems can be broadly placed within three categories: 1) marketing, 2) technical and 3) standards (Figure 3). Most of the perceived problems come within one or two of these categories but the implications for the cost and price of organic seed spans all three of the categories.

It should be noted that the seed companies interviewed were not necessarily wholly negative about organic seed production and not all of them shared the same views regarding possible problems associated with production. Moreover, not all of the problems raised were seen as insurmountable obstacles to organic seed production but rather problems that may need solutions or clarifications before a commitment to organic seed production could be made.

The issues outlined by the seed companies are given below under the category heading into which they fall (Figure 3). Each issue presented is followed by some comments on the context of the perceived problems. This includes possible solutions to the problems presented, plus an identification of specific research being carried out on these issues, where appropriate and where further research may be needed. Some opinions from European organisations already producing organic seed are also included.

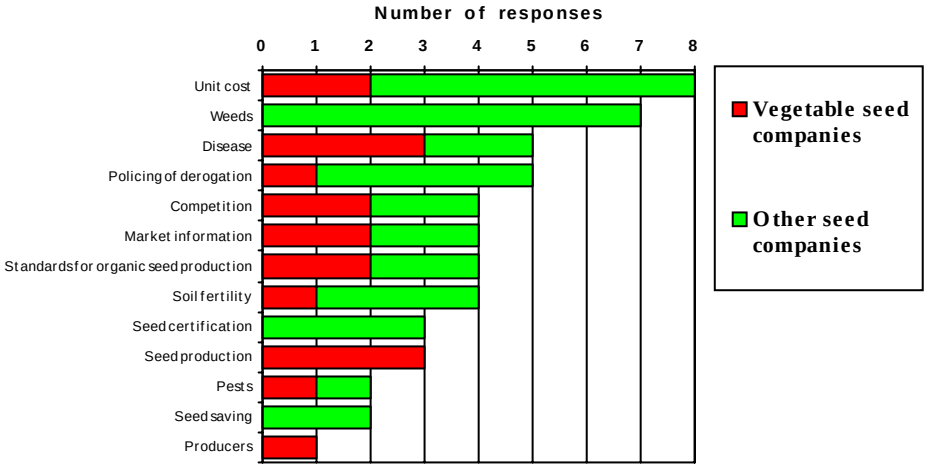

Figure 2. Perceived problems or obstacles associated with organic seed production as viewed by fourteen UK seed companies interested in producing organic seed (5 vegetable seed companies and 9 other seed companies). These issues are ranked by the frequency in which they arose and do not necessarily reflect any ranking of importance given by the individuals.

5.1 MARKETING ISSUES

5.1.1 MARKET INFORMATION

Four of the seed companies (two vegetable and two agricultural seed companies) that were surveyed wanted information regarding the size and type of market for organic seed before they felt they could commit time and resources to organic seed production. This was especially the case for the larger seed companies with shareholders to whom they need to justify all production aspects within a given budget for the development of each variety. The type of information they require includes the range of species and varieties that are likely to be used by organic farmers and growers and how much seed would be needed per crop to meet current demands plus how the demand is likely grow in the future. The seed companies felt that this type of information is lacking and because organic production in the UK is currently quite small (0.5% of total agricultural land area in 1998: Lampkin, pers. comm.), then some seed companies have said that without this type of information they are not likely to become involved in organic seed production.

5.1.1.1 Comment

- Lack of market information is not a real obstacle to organic seed production.
- Seed companies should expect to conduct their own market research as they would for other seed products and should regard organic seed production as a market opportunity within a growing sector.
- This report and others (Soil Association, 1999) have produced estimates of the demand for organic seed. Such information is based on assumptions and can only be used as estimates for the future. A better source of information would be available if the MAFF census data included separate information on organic agriculture.
- Discussion groups involving organic producers and seed producers could be set up to identify:
  - Types and amounts of seed required by organic producers,
  - Seed prices agreeable to both seed companies and organic producers,
  - Production plans that will meet organic producers needs and can offer guaranteed sale of seed for the seed companies.

5.1.2 SEED SAVING

A concern for two of the seed companies interviewed was that of seed saving by organic producers. This was a problem perceived by cereal seed producers but not by vegetable seed producers.

5.1.2.1 Cereals

By the EU definition of organic seed, a seed from a crop planted and raised organically for at least one generation is regarded as organic. Because of this, two of the seed companies see farm-saved seed as a threat to their potential market and hold the view that seed saving will not help the development of organic seed production and should be stopped if possible. Their main concern is that they anticipate the production costs of organic seed to be high and so they fear that organic producers would rather save their own seed, where possible, than buy commercially available organic seed, in order to keep farm costs down. This is also a problem for seed companies when dealing with the conventional sector as can be seen by the increasing use of mobile seed cleaning and treatment units for processing saved seed.

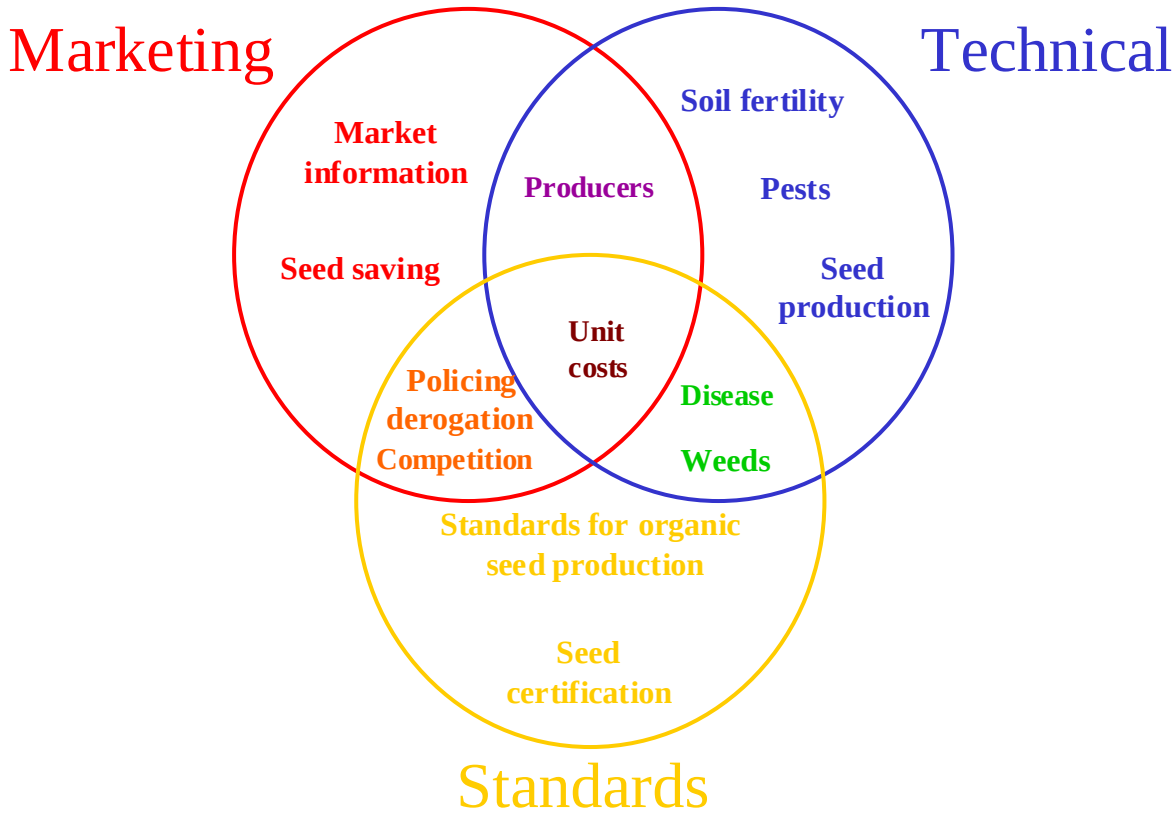

Figure 3. Categories into which the perceived problems and obstacles associated with organic seed production fall.

5.1.2.2 Comment

- Seed saving is a greater issue for agricultural and annual crops than for biennial and horticultural crops.
- Seed saving currently takes place in the conventional sector thus should not be viewed by the seed companies as a reason to avoid taking part in organic seed production.
- Seed saving would allow more organically produced varieties to be available to organic producers.
- Education programmes could be devised to promote seed saving skills for organic producers.

5.2 MARKETING / TECHNICAL ISSUES

5.2.1 PRODUCERS

One of the vegetable seed companies said there were not enough producers willing to produce organic seed at present. This may be a reflection of the fact that the majority of organically managed land in the UK is currently undergoing conversion (66%) and so is unsuitable for seed production. Moreover, a further issue may be that there is not enough expertise in seed production for those producers who might otherwise have the land capacity to produce organic seed under contract with a seed company.

5.2.1.1 Comment

- The conversion of land to organic status usually takes two years; thus land will become available for organic seed production within this time span.
- Training programmes involving organic producers and conventional seed companies could be devised to exchange skills. This would:
  - achieve an increase in the confidence of organic farmers in producing seed,
  - provide seed companies with the skills in organic production techniques.

  This type of initiative should be undertaken on a European basis.
- An organic seed working group co-ordinated by the Soil Association and part funded by MAFF is currently involved in exchanging information between the conventional seed sector and the organic sector.

5.3 TECHNICAL ISSUES

5.3.1 SOIL FERTILITY

Of the seed companies interviewed, four thought that soil fertility might be a problem in organic seed production mainly because the use of soluble nitrogen fertiliser (N) is prohibited on organic land. Only one of these seed companies produced vegetable seed.

5.3.1.1 Agricultural seed

The main concerns raised by the agricultural seed companies were for oil seed rape and grass crops. In the case of oil seed rape, one seed company said that it requires high soil fertility, which they felt could not be properly catered for by manure applications. Moreover, in the case of grass crops, two other seed companies said that they also need high soil fertility and that mineral N was required during growth to encourage certain growth stages. In conventional grass seed production, soluble fertiliser N would be applied to encourage tillering and then more applications to encourage the grass to flower upright and then to lodge so that it can be harvested. If the grass plants do not lodge then there is a risk that the seed would fall from the seed heads before harvest.

5.3.1.2 Vegetable seed

Another concern was that in vegetable seed production, if the soil were too fertile this would encourage lush vegetative growth of the crops, which may then be more susceptible to pests and disease. Moreover high soil N may delay seed head development because vegetative growth would be encouraged in preference. One vegetable seed company said that this would produce inferior vegetable seed and that they would be concerned that the organic producer would not be able to quantify the levels of N in the soil or in any manure applications.

5.3.1.3 Comment

- Organic farms do not rely only on manure applications for nutrient inputs.
- The primary function of the rotation system used on organic farms is to build soil fertility by using:
  - N-fixing legumes
  - green manure crops

  Due to this, organic farms have nutrient-rich soils.
- Further research may be required if lodging for grass seed crops is not as effective on organic systems as on conventional ones.
- Current MAFF-funded research lead by ADAS Consulting Ltd. (OF 0178) is examining the improvement of N use and performance of arable crops on organic farms using an expert group approach. Findings from this and other research may help in improving N use for organic seed production.
- Over fertile soils can be avoided for vegetable seed production by sensible placing within the rotation i.e. not directly after a fertility-building crop. A MAFF-funded project at Horticultural Research International (OF 0166) looking at the economic and agronomic feasibility of organic vegetable seed production in the UK may be able to provide information on this issue.
- Soil fertility is not an obstacle to organic seed production and is only presumed to be so due to a lack of knowledge of organic farming systems in the conventional seed industry.

5.3.2 PESTS

Pests were thought to be a general problem by two of the seed companies interviewed (one vegetable and one agricultural seed company) mainly because of the risk that the pests bring to the seed crop. In organic farming, the use of chemical pesticides is prohibited and so it is perceived that if pests do attack an organic seed crop, the crop is likely to be reduced and this type of risk is likely to be reflected in the price of the seed.

5.3.2.1 Comment

- Seed crops produced in poly-tunnels or glasshouses can benefit greatly from biological control methods.
- In well-established organic field systems, the robust rotation systems used allow breaks in the build up of pest cycles.
- In the field, pest control can be achieved by using:
  - companion planting and wildlife corridors that encourage an increase in natural pest predators,
  - plant varieties that are resistant to pest attacks,
  - a limited range of permitted, natural substances and methods noted in the UKROFS Standards for Organic Food Production.
- A research project on companion cropping for field vegetables led by ADAS Consulting Ltd. and funded by MAFF (OF 0181) is currently being undertaken and may provide valuable information for pest control.
- MAFF-funded research by the Institute of Arable Crop Research (IACR) on using nematodes for slug control (OF 0137) has been undertaken and further work on the control of slug damage at the IACR (OF 0156) is on going.

5.3.3 SEED PRODUCTION

Specific technical aspects of organic seed production for F1 hybrids and biennial crops were expressed as problems by three vegetable seed companies. The technical problems associated with agricultural seed crops are discussed within other categories.

5.3.3.1 F1 hybrids - vegetables

Many vegetable varieties used by farmers and growers are F1 hybrids and these have known parents, one of which is a pollinator line and the other a male sterile line that cannot produce functioning pollen. These two parent lines are planted in alternate rows and insects are used to transfer the pollen to the male sterile plants. Once pollination has occurred, the pollinator lines are removed by a rotavator to prevent the self-pollination of this line, which would produce inferior seeds (sibs). The progeny from the two parents is

true F1 hybrid seed and these particular varieties can not be produced generatively. In the opinion of the seed companies, most vegetable seed production is for hybrid varieties rather than for open pollinated varieties. However, hybrid varieties are very difficult to produce conventionally because the process can be affected by many uncontrollable factors. One problem is bad weather because the flowering of the two parent lines has to be co-ordinated so that pollination can take place between the parent rows. Humidity and temperature also affect the pollination process, both in terms of influencing the availability of bees or other pollinating insects, and the development of one parent in relation to the other, which may mean that simultaneous flowering can not be achieved. It was argued by some of the seed companies that these are the problems faced in the large scale production of conventional vegetable seed and the situation for organic seed is likely to be worse because of the extra burdens of increased disease and pests. Moreover, due to the unpredictable UK weather, it is unlikely that F1 hybrid varieties could be produced on a large scale in the UK for the organic market.

Another problem with some F1 hybrid crops is inducing sterility in the male sterile parent lines. Male sterility is increasingly being used for F1 hybrid production. One of the problems raised was that for some vegetables, a common method for inducing male sterility is to use chemicals and some seed companies assume that this technology would not be permitted in organic seed production. In Holland, the use of silver nitrate for inducing male sterility is currently permitted, according to a Dutch seed company that uses this technique. However, this company is currently investigating alternative methods for producing this seed. One seed company said that if F1 hybrids could not be produced using chemicals, this would have a great effect on the availability of certain vegetable seeds such as pumpkins, marrows and courgettes which are almost all produced in this way.

5.3.3.1.1 Comment

- No provision in the organic farming standards prevents the use of F1 hybrids that are produced using chemicals for male sterility.
- Certain techniques used in producing F1 hybrids are not appropriate for organic farming.
- At present, it would be to the detriment of organic farming to restrict the use of F1 hybrid seed. Research carried out by Lammerts van Bueren *et al.* (1999) concluded that using certain techniques to induce male sterility in hybrid parent lines is not necessarily appropriate for organic farming but to impose an immediate ban on them would set organic farmers back twenty years and have dramatic economic consequences.
- The control over F1 hybrid varieties that is exerted by seed companies is not conducive to offering choice to organic producers.
- Organic seed production should focus on open pollinated crop varieties in the long term.
- More research is needed into alternative ways of producing varieties that are as successful as the F1 hybrids currently in use.

5.3.3.2 Biennial crops - vegetables

Another perceived problem with producing organic F1 hybrids is that the parent plants are generally weaker than open pollinated varieties, which is a function of the breeding technique. For example, the parent plants are likely to be very susceptible to pests and diseases, especially if the crop is also a biennial vegetable. Biennial vegetables such as brassicas and carrots take two years to grow from seed to seed production. The first growing phase is vegetative, and the following stage is reproductive when pollination takes place and the seeds are produced. In the opinion of some of the seed companies, this gives a long period within which the plants are vulnerable to attacks by pests and diseases.

Brassicas were also noted as potentially having a lot of disease problems. This is because brassicas have a large amount of green growth during the vegetative stage and once they get over-mature, which is necessary for the progression to the reproductive stage, this is ideal for disease and can stop the plant flowering if the attack is bad enough. In the conventional sector, this problem can be controlled with fungicides but in organic systems, it is thought that a two-year build up of disease may occur when producing seed for biennial crops. Disease problems can be better controlled within a glasshouse or indoor environment because temperature, water and humidity can be controlled. However, brassica seed is usually produced outside so that large quantities of seed can be produced.

5.3.3.2.1 Comment

- Most of the organic seed that is available commercially are mainly annual crops that can be grown to set seed within one growing season and are usually produced under protection.
- Disease problems may be the reason behind the lack of organic seed for brassicas.
- Specific research into the production of brassica seed may be required to look at disease and pest problems especially under field conditions.
- The MAFF funded project looking at the economic and agronomic feasibility of organic vegetable seed production in the UK (at Horticulture Research International - OF 0166) may also offer valuable information.

5.4 TECHNICAL / STANDARDS ISSUES

5.4.1 DISEASES

Risks from disease were stated as a major problem by five of the seed companies interviewed and included both agricultural (two) and horticultural (three) seed producers. It was generally thought that organically produced seed would carry high levels of disease because they cannot be controlled by chemical use, as in conventional agriculture. Not only are there concerns that seed borne diseases will be passed on, but also that soil borne diseases are likely to attack the seed crops and potentially cause dramatic losses in yields. Because of these assumptions, many seed companies think that organic seed could not be produced to the same high standards

as conventional seed. In conventional systems, seed crops can be sprayed during the plant growth period to prevent disease, and the seed can be treated post harvest to provide protection from seed and soil borne diseases when it is sown. Due to these practices, conventional seeds can be produced with no infection, which is a standard required to meet the higher voluntary standards (HVS) of the seed certification system for agricultural crops. Some of the cereal seed companies argued that to allow the certification of organic seed, there should be lower standards with regard to disease content. However, if this were to happen, this could be a source of disease that organic farmers could import into an otherwise 'clean' system.

5.4.1.1 Comment

- The diseases experienced in conventional seed production may not be worse on organic farms (ADAS, 1991; see Annex 6).
- Soil borne diseases in organic farms can be largely controlled by crop rotation.
- Rigorous seed testing would eliminate seed borne disease.
- Ways of avoiding disease during organic seed production would be:
  - to use the most resistant varieties possible,
  - to produce difficult crops within glasshouses, or poly tunnels where –
    - the environment can be controlled
    - there is less likelihood of windblown fungal spores causing disease infection,
  - to use antagonistic bacteria and other micro-organisms found in nature,
  - to use approved plant oils such as mint oil and pine oil (however, this type of neo-conventional control should be avoided as much as possible),
  - to treat seeds with hot water, which was a common treatment prior to the development of chemical fungicides,
  - to grade cereal seed because larger grains are less likely to have seed borne diseases (Piorr, 1991; see Annex 6).
- Current MAFF-funded research lead by ADAS Consulting Ltd. (OF 0168) on the development of disease control strategies for organically grown field vegetables is on going.
- Research is needed to find further ways of controlling disease and to investigate the commercial effectiveness of appropriate methods that may already exist.

5.4.2 WEEDS

Weeds were seen as a major potential problem by seven of the seed companies interviewed especially for cereals and grass crops. The vegetable seed companies did not mention weeds as being a major perceived problem in production.

5.4.2.1 Cereals and agricultural crops

In general the presence of weeds in a seed crop can mean that the crop will not meet seed certification standards. The prospect of organic seed not being able to meet the HVS is the main worry for cereal producers as this is likely to affect the marketability of the seed. Under these standards a high content of weeds in the seed crop can mean that the crop is rejected at the field growing stage by a seed certification inspector. Many of the seed companies feel that because weeds in an organic seed crop can not be controlled by herbicides, this will cause a major problem. Thus it is generally regarded that the only way that organic cereal seed can be produced, is to EU minimum standards in which stringent rules regarding weed content in seed crops are not included. However, to make the seed marketable, the seed companies anticipate that much more cleaning and processing of the seed crop will need to take place post-harvest which will affect the seed price. Moreover, they also perceive that during the field stage, hand weeding would be needed, increasing labour costs which would be reflected in the price of the seed.

One cereal seed company suggested that they might be able to reach HVS in cereals during the cleaning and processing stage by sieving out weed seed. This may mean that even if HVS could not be met in the field, it could be reached after cleaning. If this approach were to be taken, this would require changes in the seed certification standards for HVS to avoid the rejection of crops in the field. However, it was suggested that this would not necessarily work for all combinations of crops and weed seeds. For example, it is generally thought difficult to clean weed seed from grass crops in the cleaning and processing stage.

The main problems that were specified included wild oats in cereal seed crops but especially in oat seed crops where they are particularly difficult to identify. Moreover, wild radish and cleavers in wheat was perceived to be a problem and blackgrass, sterile brome and other weed grasses within grass seed crops, most of which would usually be sprayed-off in conventional seed crops.

5.4.2.2 Comment

- Not all organic farms are rife with weeds.
- Weeds like cleavers and blackgrass are not great problems for well-established organic farms and only ranked 9th and 10th on a list of weeds perceived to be problematic in winter wheat by 24 organic farmers (EFRC 1996).
- The rotation systems on organic farms aid the control of weeds especially when alternating between:
  - spring and autumn germinating crops,
  - closed and open crops.
- Docks and wild oats were perceived to be the two most problematic weeds in organic cereals (EFRC 1996) but these can be avoided by:

  - careful site selection,
  - complementary roguing,
  - careful timing in sowing seed crops.

- Various mechanical techniques can be used to control weeds such as:
  - ploughing a field to below the seed germination depth (this buries weed seeds so that they do not germinate),
  - inter-row hoeing (used for crops grown in rows)
  - thermal weeding (using flame equipment to burn off the weeds prior to sowing the seed crop).

- Variety selection can be an important factor in controlling weeds. Köpke (personal communication) found that by using wheat varieties with planophile leaves which occupy horizontal positions, the incidence of the disease *Septoria nodorum* (causes leaf blotch) and weeds were greatly reduced when compared with varieties with erectophile leaf morphologies.

- Most weed seeds can be cleaned out of cereals and pulses with sophisticated cleaning machinery available today.

- There is no reason why organic seed should not produced to the same high standards as conventional seeds particularly on standards of weed content.

5.5 STANDARDS ISSUES

5.5.1 STANDARDS FOR ORGANIC SEED PRODUCTION

Four of the seed companies interviewed said that not enough was known about the required standards for the production of organic seed (two were vegetable seed companies and two were agricultural seed companies). This not only included standards in relation to the existing certification standards for conventional seed and how these would relate to organic seed, but also the organic standards required. These seed companies argued that the definition of organic seed was not sufficient. The EU Regulation on organic farming (2092/91) defines organic seed as being produced from crops grown organically for at least one generation. However, this definition does not include the harvesting, processing and packaging aspects of seed production. Some of the seed companies would like the entire process of production (from the field to the end product) to be defined so that they can assess the resources required for organic seed production. Factors such as the necessity for separate harvesting rigs, cleaning processes, and storage facilities need to be addressed. At present, they believe that there is scope for misunderstanding what is required or misinterpretation of the existing standards.

5.5.1.1 Comment

- Currently no standards for organic seed production exist in the United Kingdom Register of Organic Food Standards (UKROFS).

- Separate guidelines for organic seed production should be drawn up by certification bodies in conjunction with seed producers.

5.5.2 SEED CERTIFICATION

5.5.2.1 Cereals and agricultural crops

The existing seed certification system is perceived to be a potential problem for organically produced seed by three cereal seed companies interviewed. Problems such as disease and weed content have already been discussed in this context. The seed companies think that the seed certification standards should be relaxed for organic production so that the seed can be marketed, otherwise there would be no point in producing it.

An additional problem is that for some agricultural crops, the cost of certifying small quantities of seed will be high because seed certification is charged by lots of up to 25 tonnes for cereals and 10 tonnes for small seeds. Therefore there will be relatively high seed certification costs for the relatively small amounts of organic seed that are likely to be produced

5.5.2.2 Comment

- Changing the seed certification legislation would not seem to be beneficial for the organic sector because allowing a greater content of disease and weeds in organic seed is likely to cause problems for organic farmers.

- Organic seed should be able to attain the high seed certification standards; however, the initial costs may be high.

5.6 STANDARDS / MARKETING ISSUES

5.6.1 POLICING OF THE DEROGATION

The policing of seed use under the derogation period was seen as a very important issue for five of the seed companies interviewed (one vegetable and four agricultural seed companies). The EU Regulation states that under the current derogation conventional seed can be used on organic farms only when appropriate varieties of organic seed cannot be sourced. Many of the seed companies are worried that if they develop organic seed before the end of the derogation period, they will not be able to sell it because organic producers would opt to buy conventional seed under the derogation because it would be cheaper than organic seed. Many of the seed companies see this as a risk to any investment they are likely to make in developing organic seed lines. At the start of this project, the derogation period was due to end on 31 December 2000, however, it was extended in June 1999 to 31 December 2003. Many of the seed companies regarded the derogation extension as a possible hazard for their potential organic market, and that only those who were committed to organic seed production would continue to develop lines during this period. Others would wait until they had a guaranteed market at the end of the derogation period. The seed companies in this study would like to see in place a commitment from the organic sector bodies to ensure that organic seed is bought during the derogation period. This would mean that the sector bodies would need to have records of all available organic varieties and identify alternative varieties that would be able to used for various

crop needs. In the past it has been felt that the sector bodies have not been rigorous enough in policing the use of conventional seed under the derogation to make sure that organic seed supplies are tapped.

5.6.1.1 Comment

- Organic seed producers should inform UKROFS when any new organic seed variety comes online plus how much is available.
- This information should then be distributed to the sector bodies and organic producers.
- Future requests for conventional seed under the derogation can be assessed in the light of the available organic seed.
- Sweden could be used as a case study in order to investigate the potential of such a system in the UK.

5.6.2 COMPETITION

Four of the seed companies interviewed (two vegetable and two agricultural seed companies) were of the opinion that potential competition could be a problem and may be a factor that they would have to consider before getting involved in organic seed production. The problem involved with competition comprises two issues: 1) the relatively small organic market, 2) the standards of production of imported seed. The first issue arises from the forecasts of the amounts of seed needed by the organic sector. Both the vegetable and cereal seed companies said that the amounts were very small compared to their conventional market, and that for most crops, any individual seed company alone could produce the amounts required. Therefore their main concern would be that a lot of seed companies would produce the same species and varieties thus leading to a surfeit of seed on the market that would not get sold. They suggested that the best way forward would be some sort of co-ordination of production so that certain companies could concentrate on certain varieties or that companies could share the production of crops to avoid over-production.

The second concern that the seed companies had was unfair competition from European and other countries. Many of them felt that the seed production standards of conventional seed are much higher in the UK than in other countries and so their concern would also be for the production of organic seed. They would like to know that the seed imported into the UK was produced to both the same seed standards and the same organic standards as in the UK. If imported organic seed was produced to lower or different standards, then this may give the overseas seed producer an advantage on price in the market. The seed companies argued that there should be traceability of seed so that the standards of production can be assessed. Moreover, they would like to know that the organic standards from other countries are the same as in the UK because this could affect their decisions on whether or not to become involved in organic seed production.

5.6.2.1 Comment

- Surfeits in certain species and varieties of organic seed could be avoided by:
  - setting up a seed production co-operative preferably including organic producers so that production requirements could be agreed and production co-ordination could be set out,
  - storing organic seed until there is a market for it (to allow a viable quantity of production of popular species and varieties).
- The condition for the optimum storage of bulk seed is an area where further research is needed.
- A survey of the organic standards of European and other sector bodies is needed to identify possible discrepancies in organic seed production.
- European standards for organic seed production may be required in the long-term.

5.7 MARKETING / TECHNICAL / STANDARDS ISSUES

5.7.1 UNIT COSTS

One of the most important factors associated with organic seed production as expressed by eight out of the fourteen seed companies interviewed was the cost of production and the price to the farmer. All of these seed companies (two vegetable and six agricultural seed companies) anticipated that organic seed would cost between 2 and 6 times as much as conventional seed, and that the organic producers may not be able to afford to buy it which would make the organic seed market collapse. Moreover, under the current derogation for the use of conventional seed, many of the seed companies feel that they will not be able to compete with the conventional seed prices. Many of the seed companies think the cost will be higher for organic seed because the workload will be greater and more labour intensive. They think that more weeding will be needed and that the cleaning and processing procedures will also need to be more rigorous for organic seed. They also assume costs will be greater because they will have to provide separate (or dedicated) cleaning and processing lines which will add to overhead costs. Moreover, they think the cost will also have to reflect the increased risk of crop failure due to pests and diseases.

Furthermore, some seed companies felt that the seed should cost more because the end organic product of the seed is worth more and so this should be reflected in the seed price. Most seed companies felt that they could produce an organic seed product but that they need to know what organic producers can afford. For example, if organic seed is likely to cost three times as much as conventional seed, they would want to know if this price increase could be carried by organic producers before they would want to commit themselves to organic seed production. Organic seed producers in the Netherlands said that the cost of organic seed production depends of the type of crop they are producing. For example, to produce a carrot organically would approximately 3-4 times as much as the conventional seed they produce because the seed yields for carrots can be very poor. However, organic lettuce seed can cost about twice as much as conventional seed.

5.7.1.1 Comment

- Organic cereal and pulse seed should cost no more that twice that of conventional seed to produce.
- Organic vegetable seed production costs are likely to vary with the species and varieties produced.
- Guidelines for organic seed production should be drawn up to clarify the facility and labour requirements.
- A system to ensure that any available organic seed is bought in preference to conventional seed should be set up.

6 CONCLUSIONS

Most of the problems expressed by the seed companies interviewed, are perceived problems and not actual problems that they have encountered. The forecast of the demand for organic seed shows that the demand for seed in 2002 is likely to have doubled for cereal seed, tripled for vegetable seed and be 7-8 times as great as grassland crops compared with the demand in 1997. With the current trend in organic seed production, these demands will not be met at the end of the derogation period unless a massive increase in production takes place. Organic seed production must go ahead.

Many of the perceived technical problems presented by the seed companies stem from a lack of understanding and/or knowledge of organic agricultural systems. For example, problems regarding soil fertility, pests, diseases and weeds can be adequately controlled on organic systems. Further work is required on weed, pest and disease strategies but the current situation is not desperate and is not a great obstacle to organic seed production.

The technical problems associated with the production of F1 hybrid varieties raises the question of whether they are appropriate for use in organic agriculture. F1 hybrids are used in favour of open-pollinated varieties because of improved yield and resistance characteristics. However, if chemicals are used to promote male sterility in one of the parent lines, this does not comply with the principles of organic production. Therefore, this issue ought to be addressed by the certification bodies and account of this should be taken in the organic production standards with a view to producing organic seed production guidelines. In the long-term it would be better if breeders of organic varieties concentrate on producing open-pollinated lines. Improved organic variety trials would enable the selection of appropriate varieties under organic conditions. MAFF-sponsored vegetable variety trials have been undertaken by the National Institute of Agricultural Botany (NIAB) on organic land from 1991. However, the range of vegetables tested has been limited in the past. Moreover, most of the seed used on these trials has not been organically produced. Up until now, there have been limited organic cereal trials. Trials of winter wheat varieties and mixtures of winter wheat, triticale and oats are currently being undertaken by Elm Farm Research Centre. NIAB has also started trials this year on pure stands of cereal varieties under organic conditions. Further work on organic varieties is necessary so that a wide range of species and varieties can be tested to enable choice and biodiversity to be maintained in the organic sector.

Actual problems in organic seed production may stem from potentially different opinions of other countries regarding the production and use of organic seed. The survey conducted as part of this study on the opinions and actions of other countries regarding the organic seed issue got a very poor response which could be viewed as complacency. It has been very difficult to collect information on how other countries are going to deal with organic seed production especially in light of differences in seed production standards for the conventional sector. The UK may be at a disadvantage if both high organic standards and seed standards are being met by UK industry and not by those of other countries. It is necessary for further research to be undertaken on the potential discrepancies between the organic standards and seed standards of different countries to determine what impact this may have on organic producers and producers of organic seed in the UK. Furthermore, a degree of reticence regarding organic seed is obvious in the UK due to the low level of derogation requests that were received by the sector bodies in 1998. Only 21% of UK organic farmers and growers submitted derogation request forms to the sector bodies which implies that 79% of organic producers were using organic seed even though this is highly unlikely due to the current levels of seed availability. This disparity shows that up until now the sector bodies and organic producers in the UK have been somewhat apathetic about the use of organic seed during the derogation. This should not be allowed to continue to occur and strict measures need to be taken to adequately police the use of organic seed under the current derogation (until 31 December 2003).

Further blanket extensions to the derogation period after 2003 would damage the progress of an organic seed industry in the UK and Europe by providing a disincentive to potential organic seed producers. A better course of action would be to assess the availability of organic seed during 2002 and to determine where any shortages lie in terms of species and varieties. This information could then be used to decide where derogations are needed so that further derogations can be applied only for the species and varieties that are in short supply. Split derogations such as this would allow producers of organic seed to sell the lines in which they have already invested whilst allowing time for other varieties to be developed that would meet shortages.

This study has shown that the availability of organic seed in the UK is low and that which is available is not necessarily of great commercial relevance to UK organic producers. Therefore, it is necessary to stimulate an immediate advancement in the development of commercial organic seed production, otherwise there will be no hope of meeting the likely demand for seed at the end of the current derogation. Many of the problems associated with organic seed production expressed by the seed companies in this report are only perceived problems that can be overcome with education, training and discussion. However, some more significant issues need to be addressed and recommendations for further actions have been made.

7 RECOMMENDATIONS FOR FUTURE ACTIONS

1. **Press ahead with organic seed production:**
   - Guidelines in organic seed production are required.
   - Set up producer groups to provide seed production planning and agreements on market share.
   - Provide training for conventional seed producers and organic producers in organic seed production.
2. **More rigorous regulation of the derogation is required:**
   - Need to find a successful way of policing the use of organic seed.
   - Need a better return of derogation request forms in order to police the derogation.
3. **Make a commitment not to extend the current derogation:**
   - Except where shortages in supply occur.
   - Need to assess organic seed availability prior to the end of current derogation.
4. **Major improvements are required in organic variety testing to identify varieties that should be produced as organic seed:**
   - Assess the suitability of F1 hybrid varieties and the implications for organic standards.
   - Provide a greater biodiversity of seed produced organically.
5. **Further work is required on pest, disease and weed problems:**
   - Specifically related to organic seed production.
6. **Research is required on the standards of other European countries and third countries:**
   - Organic standards.
   - Seed certification standards.
   - Implications for UK organic agriculture and organic seed industry.
   - European standards for organic seed production.
7. **MAFF census data should include organic horticulture and agriculture information:**
   - To provide reliable data on organic production.

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ANNEX 1

Table 1: Organically produced seed available for 1999 and 2000, compiled by EFRC from information supplied by seed companies. (EFRC does not guarantee that the list is complete, and in no way recommends any of the varieties named). Crop "types" and variety names are exactly as supplied by the industry.

Crop	Type	Variety	Supplier*	Availability
Barley	Spring	Chariot	Enterprise	Spring 2000
	Spring	Hart	Enterprise	Spring 2000
Beans		Kentucky Wonder	Pro-Veg	1999
	Broad	Futura RZ	Rijk Zwaan	1999/2000
	Broad	Witkiem	Enza Zaden	1999
	Bush	Cantare	Enza Zaden	1999
	Bush	Caruso	Enza Zaden	1999
	Bush	Sonate	Enza Zaden	1999
	Climbing	Eva	D T Brown	1999/2000
	Climbing round	Farba RZ	Rijk Zwaan	1999/2000
	Climbing round	Fidel RZ	Rijk Zwaan	Dec 1999
	Climbing	Hilda	D T Brown	2000
	Climbing flat	Mantra RZ	Rijk Zwaan	1999
	Climbing French	Markant	Enza Zaden	1999
	Climbing	Neckar Queen	D T Brown	1999/2000
	Climbing French	Toplong	Enza Zaden	1999
		Blue Lake	Pro-Veg	1999
	Dwarf French	Hidora	D T Brown	2000
	Dwarf	Maxi	D T Brown	1999/2000
	Dwarf	Modus	D T Brown	1999/2000
		Tendergreen	Pro-Veg	1999
	Pole slicing	Helda	Enza Zaden	1998
Beetroot		Alvro Mono	Enza Zaden	1999
		Detroit 2 Bolivar	D T Brown	1999/2000
		Early Wonder Tall Top	Pro-Veg	1999
		Libero RZ	Rijk Zwaan	1999/2000
Broccoli		Calabrese	Pro-Veg	1999
Brussel Sprouts		Igor F1	D T Brown	2000
Cabbage		Marner Large Red	D T Brown	2000
		Marner Large White	D T Brown	2000
	Savoy	Vorbote 3	D T Brown	2000
Carrot	Amsterdamse bak	Diava RZ	Rijk Zwaan	Apr 2000
	Berlikumer	Feria RZ	Rijk Zwaan	Mar 2001
	Processing	Karotan RZ	Rijk Zwaan	Apr 2000
		Kuroda	Pro-Veg	1999
	Berlikumer	Magno RZ	Rijk Zwaan	Mar 2000
		Rothild	D T Brown	1999/2000
		Starca F1	D T Brown	2000
Cauliflower		Flora Blanca	Enza Zaden	1999
	Open pollinated	Celesta RZ	Rijk Zwaan	Apr 2000
	F1 Hybrid	Asterix RZ	Rijk Zwaan	Apr 2000
Celeriac		Mars	D T Brown	2000
		President RZ	Rijk Zwaan	1999/2000
		Prinz	D T Brown	2000
Celery		A'damse Donkergroene	Enza Zaden	1999
		Ibis	Enza Zaden	1999
		Imperial RZ	Rijk Zwaan	1999/2000
		Utah 52.70	Enza Zaden	1999
Cornsalad		Vit	D T Brown	1999/2000
Courgette		Parthenon F1	D T Brown	2000

Table 1: continued.

Crop	Type	Variety	Supplier*	Availability
Cress		Selection 74	D T Brown	1999/2000
	Garden	Sprint	Enza Zaden	1999
Cucumber	Slicer	Akito ez F1	Enza Zaden	1999
		Cumlaude RZ	Rijk Zwaan	1999/2000
	Long	Defense ez F1	Enza Zaden	1999
		Deltastar RZ	Rijk Zwaan	Dec 1999
		Enigma RZ	Rijk Zwaan	1999/2000
		Flamingo F1	D T Brown	2000
		Flamingo F1	Elsoms	1999
		Heike F1	D T Brown	1999/2000
		Long Green Imp	Pro-Veg	1999
		Macao F1	Elsoms	1999
		Media RZ	Rijk Zwaan	Dec 1999
		Paska F1	D T Brown	2000
	Pickling	Stimora F1	D T Brown	2000
	Long	Styx ez F1	Enza Zaden	1999
		Tanja	D T Brown	1999/2000
Endive		Avance ez	Enza Zaden	1999
		Breedblad Volhart Winter	Enza Zaden	1999
		Bubikopf 2 Grobo	D T Brown	1999/2000
		Despa	D T Brown	2000
		Dimara ez	Enza Zaden	1999
	Curled	Ione ez	Enza Zaden	1999
		Lisbet ez	Enza Zaden	1999
	Curled	Markant ez	Enza Zaden	1999
	Curled	Midori ez	Enza Zaden	1999
	Fisee	Monaco RZ	Rijk Zwaan	1999/2000
		Nuance ez	Enza Zaden	1999
		Nummer Vijf 2	Enza Zaden	1999
		Sardana ez	Enza Zaden	1999
	Escarole	Stategо RZ	Rijk Zwaan	1999/2000
Fennel		Argo RZ	Rijk Zwaan	Feb 2000
		Zefa Fino	Enza Zaden	1999
Gourd		Bottle	Pro-Veg	1999
Herbs	Basil	Sweet Genovese	D T Brown	1999/2000
	Borage		D T Brown	1999/2000
	Chives	Polycross	D T Brown	1999/2000
	Coriander		Pro-Veg	1999
	Dill	Bouquet	Pro-Veg	1999
	Dill	Tetra	D T Brown	1999/2000
	Lemon Balm		D T Brown	1999/2000
	Marjoram		D T Brown	1999/2000
	Parsley	Green Pearl	D T Brown	1999/2000
	Parsley	Curly leaf	Rijk Zwaan	Apr 2000
	Parsley	Moss Curled	Pro-Veg	1999
	Summer Savory		D T Brown	1999/2000
Kale		Red Winter	Pro-Veg	1999
		Westlandse Winter	Enza Zaden	1999
Kohl Rabi		Azur Star	D T Brown	2000
		Logo	D T Brown	1999/2000
Leek		Alora RZ	Rijk Zwaan	1999/2000
	Blue green	Alvito RZ	Rijk Zwaan	1999/2000
		Autumn Mammoth 2 Hannibal	D T Brown	1999/2000
		Blaugruner Winter Farinto	D T Brown	2000

Table 1: continued.

Crop	Type	Variety	Supplier*	Availability
Lettuce	Lollo Rossa	Amorina	D T Brown	2000
	Lollo Rossa	Amorina	Elsoms	1999
	Glasshouse	Atala ez	Enza Zaden	1999
	Cos	Bacio ez	Enza Zaden	1999
	Green Oakleaf	Basic	Elsoms	1999
	Lollo Bionda	Bergamo	Elsoms	1999
	Leaf Red	Bijou ez	Enza Zaden	1999
		Black Seeded Simpson	Pro-Veg	1999
	Lollo Bionda	Bolzano	Elsoms	1999
		Buttercrunch	Pro-Veg	1999
	Batavia Glasshouse Red	Capora ez	Enza Zaden	1999
	Leaf Red	Cerize ez	Enza Zaden	1999
	Outdoor	Cervia ez	Enza Zaden	1999
	Leaf Red	Cocarde	Enza Zaden	1999
	Leaf Green	Compass ez	Enza Zaden	1999
	Outdoor	Crufia ez	Enza Zaden	1999
		Dark Lollo Rosso	Pro-Veg	1999
		Deer Tongue	Pro-Veg	1999
	Outdoor Iceburg	Dublin	Elsoms	1999
	Outdoor Butterhead	Dynamite	D T Brown	2000
	Outdoor Butterhead	Dynamite (LM 8021)	Elsoms	1999
	Leaf Red	E 19.1222	Enza Zaden	1999
	Outdoor Butterhead	Edito	D T Brown	2000
	Outdoor Butterhead	Edito	Elsoms	1999
	Iceburg	Embrace ez	Enza Zaden	1999
	Outdoor	Enya ez	Enza Zaden	1999
	Glasshouse	Erika ez	Enza Zaden	1999
	Indoor Butterhead	Flandria RZ	Rijk Zwaan	1999/2000
	Outdoor Butterhead	Franca	Elsoms	1999
	Outdoor	Garuda ez	Enza Zaden	1999
	Indoor Butterhead shortday	Gomera	Elsoms	1999
		Green Salad Bowl	Pro-Veg	1999
	Iceburg	Iglo RZ	Rijk Zwaan	1999/2000
		Kellys	D T Brown	2000
	Indoor Crisp shortday	Kellys	Elsoms	1999
	Outdoor long day oakleaf	Kristine RZ	Rijk Zwaan	Feb 2000
	Outdoor Butterhead	Libusa RZ	Rijk Zwaan	1999/2000
	Outdoor	Lizzy ez	Enza Zaden	1999
	Indoor Curly	LM 1814 (Zoya)	Elsoms	1999
	Outdoor Cos	LM 8931	Elsoms	1999
	Leaf Green	Lobi ez	Enza Zaden	1999
	Outdoor Double red lollo rossa	Malibu RZ	Rijk Zwaan	1999/2000
		Marveille 4 Seasons	Pro-Veg	1999
		Maserati	D T Brown	2000
	Red Oakleaf	Maseerati	Elsoms	1999
	Red Butterhead	Mikola ez	Enza Zaden	1999
		Milan	D T Brown	1999/2000
		Oakleaf	Pro-Veg	1999
	Outdoor Green batavia	Pantheon RZ	Rijk Zwaan	1999/2000
	Cos	Paris Island	Pro-Veg	1999
	Cos	Parris Island	Enza Zaden	1999
	Cos	Pinokkio ez	Enza Zaden	1999
	Outdoor Butterhead	Punch	Elsoms	1999
		Red Salad Bowl	Pro-Veg	1999

Table 1: continued.

Crop	Type	Variety	Supplier*	Availability
Lettuce continued	Cos	Remus RZ	Rijk Zwaan	1999/2000
	Lollo Rossa	Revolution	D T Brown	2000
	Lollo Rossa	Revolution	Elsoms	1999
	Batavia Glasshouse Red	Roger ez	Enza Zaden	1999
		Rouge Di Hiver	Pro-Veg	1999
	Iceburg	Roxette RZ	Rijk Zwaan	1999/2000
	Iceburg	Saladin	Enza Zaden	1999
	Iceburg	Set ez	Enza Zaden	1999
	Batavia Outdoor Green	Taverna ez	Enza Zaden	1999
	Batavia Outdoor Green	Tilina ez	Enza Zaden	1999
	Indoor Butterhead	Troubadour RZ	Rijk Zwaan	1999/2000
	Outdoor Single red oakleaf	Valdai RZ	Rijk Zwaan	1999
	Batavia Outdoor Green	Vanity ez	Enza Zaden	1999
	Glasshouse	Wendel ez	Enza Zaden	1999
	Batavia Glasshouse Green	Yvette ez	Enza Zaden	1999
Melon		Hearts of Gold	Pro-Veg	1999
Mustard		Mazuna	Pro-Veg	1999
		Red Giant	Pro-Veg	1999
		Tatsoi	Pro-Veg	1999
Onions		Sturon	D T Brown	2000
Peas	Pod	Record	Enza Zaden	1999
	Sugar	Dwarf Sweet Green	D T Brown	2000
		Bastion	D T Brown	2000
		Karina	D T Brown	2000
		Zamira	D T Brown	2000
		Oregon Sugar Pod II	Pro-Veg	1999
		Progress No. 9	Pro-Veg	1999
Pepper	Sweet	Bendigo ez F1	Enza Zaden	1999
	Sweet	Luteus ez F1	Enza Zaden	1999
	Sweet	Pusztagold	Enza Zaden	1999
Potato	First Earlies	Aminca	Leary's	1999/2000
	First Earlies	Concurrent	Leary's	1999/2000
	First Earlies	Home Guard	Leary's	1999/2000
	First Earlies	Junior (Dutch A)	Leary's	1999/2000
	First Earlies	Pentland Javlin	Leary's	1999/2000
	First Earlies	Premiere	Leary's	1999/2000
	First Earlies	Red Duke of York	Leary's	1999/2000
	First Earlies	Swift	Leary's	1999/2000
	Main Crop	Arran Victory	Leary's	1999/2000
	Main Crop	Avalanche	Leary's	1999/2000
	Main Crop	Cara	Leary's	1999/2000
	Main Crop	Charlotte	Leary's	1999/2000
	Main Crop	Desiree	Leary's	1999/2000
	Main Crop	Pink Fir Apple	Leary's	1999/2000
	Main Crop	Remarka	Leary's	1999/2000
	Main Crop	Sante	Leary's	1999/2000
	Main Crop	Valor	Leary's	1999/2000
	New Variety	Cosmos	Leary's	1999/2000
	New Variety	Harmony	Leary's	1999/2000
	New Variety	Osprey	Leary's	1999/2000
	New Variety	Verity	Leary's	1999/2000
	Second Earlies	Estima	Leary's	1999/2000
	Second Earlies	Kestrel	Leary's	1999/2000
	Second Earlies	Marfona	Leary's	1999/2000

Table 1: continued.

Crop	Type	Variety	Supplier*	Availability
Potatoes continued	Second Earlies	Nadine	Leary's	1999/2000
	Second Earlies	Nicola	Leary's	1999/2000
	Second Earlies	Romano	Leary's	1999/2000
	Second Earlies	Wilja	Leary's	1999/2000
Pumpkin/Squash		Greenwich	Enza Zaden	1999
		Jarradale	Pro-Veg	1999
		Long Island Cheese	Pro-Veg	1999
		Uchiki Kuri	Enza Zaden	1999
		Uchiki Kuri	D T Brown	1999/2000
		Zucchini Dark Green	Pro-Veg	1999
Radish		Belrosa RZ	Rijk Zwaan	1999/2000
		Cherrybelle	Pro-Veg	1999
		Gabino RZ	Rijk Zwaan	Mar 2000
		Raxa	D T Brown	1999/2000
	Summer	Rondeel RZ	Rijk Zwaan	Mar 2000
	Oriental	Rosa 2	D T Brown	1999/2000
		Rudi	Enza Zaden	1999
		Sirri RZ	Rijk Zwaan	1999/2000
Rocket	Wild		D T Brown	2000
Rucola		Rucola Coltivata	Enza Zaden	1999
Spinach	Outdoor	Avanti RZ	Rijk Zwaan	1999/2000
		Bloomsdale	Pro-Veg	1999
	Outdoor	Clermont RZ	Rijk Zwaan	1999/2000
		Dolphin RZ	Rijk Zwaan	Mar 2000
		Eagle RZ	Rijk Zwaan	Mar 2000
	Indoor/Outdoor	Kerdion RZ	Rijk Zwaan	Mar 2000
		Palco	D T Brown	2000
		Poncho ez F1	Enza Zaden	1999
		Primo ez F1	Enza Zaden	1999
Sunflower		Mammoth	Pro-Veg	1999
		Ornamental Mix	Pro-Veg	1999
Sweetcorn		County Gentlemen (White)	Pro-Veg	1999
		Double Standard	Pro-Veg	1999
		Golden Jubilee (Yellow)	Pro-Veg	1999
Tomato		Alexandros F1	D T Brown	2000
		Aromata	Rijk Zwaan	Jan 2000
		Carousel	Rijk Zwaan	Nov 1999
		Diplom F1	D T Brown	2000
		Durasol ez F1	Enza Zaden	1999
		E 28.30207 F1	Enza Zaden	1999
		Matina	D T Brown	1999/2000
		Moravi F1	Elsoms	1999
		Philippos F1	D T Brown	2000
		Sparta ez F1	Enza Zaden	1999
		Tomasa F1	Elsoms	1999
Turnip Tops		Mizuna	Enza Zaden	1999
		Namenia	Enza Zaden	1999
Wheat	Spring	Axona	Enterprise	Spring 2000

***The contact details of the suppliers are given in Table 2.**

Table 2: Contact details of the organic seed suppliers listed in Table 1.

Supplier (as in Table 1)	Full name & Address	Telephone	Fax
D T Brown	D T Brown & Co. Ltd. Station Road Poulton-le-Fylde Lancashire FY6 7HX	01253 883809	01253 890923
Elsoms	Elsoms Seeds Ltd Spalding Lincolnshire PE11 1QG	01775 711911	01775 712217
Enterprise	Enterprise Seeds Ltd. Clover House Boston Road Sleaford Lincolnshire NG34 7HD	01529 415555	01529 413333
Enza Zaden	Enza Zaden UK Ltd. Enza House Milber Trading Estate Newton Abbot Devon TQ12 4SG	01626 333616	01626 331457
Leary's	Leary's Organic Seed Potatoes Bindon Home Farm Langford Budville Wellington Somerset TA21 0RU	01179 238940	01179 735158
Pro-Veg	Pro-Veg Seeds Ltd. 6 Shingay Lane Sawston Cambridge CB2 4SS	01223 833001	01223 833006
Rijk Zwaan	Rijk Zwaan UK Ltd. Pocklington Industrial Estate Pocklington York YO4 2NR	01759 305830	01759 305848

ANNEX 2

Table 1. Overseas contacts

Austria	• IFÖL/BOKU – Institut für Ökologischen Landbau • Bundesministerium für Land und Forstwirschaft • Bundesamt für Agrarbiologie
Belgium	• Haest Consultancy for the Organic Industry • Ministère des Classes Moyennes et de l'Agriculture
Czech Republic	• NRFH-Nadace Rytire F. Horského • FOA-Foundation for Organic Agriculture
Denmark	• Morsø Frø A/S (Seed company, currently producing) • Research Centre for Organic farming • Danish Institute of Agricultural Sciences • Danish Plant Directorate
Egypt	• Sekem • ECOE-Egyptian Centre of Organic Agriculture
Finland	• Dept of Plant production University of Helsinki • Liitto ry Union for Organic Farming • Ministry of Agriculture and Forestry
France	• GRAB-Groupe de Recherche en Agriculture Biologique • Ministère de l'Agriculture et de la Pêche
Germany	• AGÖL – Arbeitsgemeinschaft Ökologischer Landbau • Bundesministerium für Ernährung, Landwirtschaft und Forsten
Greece	• REA-Hellenic Interscientific Society for Organic Agriculture • PAKOE-PCER-Panhellenic Centre of Ecological Researches • Directorate of Processing Standardisation and Quality Control
Hungary	• Ökoszerviz
Iceland	• Ministry of Agriculture
India	• AIFOF-All India Federation of Organic Farming • APOF-Association for Promotion of Organic Farmers
Ireland	• Irish Organic Farmers and Growers Association (IOFGA) • Department of Agriculture, Food and Forestry
Israel	• IBOAA-Israel Bio-Organic Agriculture Association
Italy	• AIAB-Associazione Italiana per l'Agricoltura Biologica • DG Per le Politich Agricole ed Agroalimentari Nationali,
Lithuania	• Ekoagros • GAJA – Lithuanian Society of Organic-Biological Agric
Luxemburg	• Verengung fir Biologesche Landbau Lëtzebuerg asbl • Ministere de l'Agriculture
Netherlands	• SKAL • Ministerie van Landbouw
New Zealand	• LEO-Biological Husbandry Group

Table 1. Continued

Norway	• Norsk Senter for Økologisk Landbruk • Norwegian Agricultural Inspection Service
Pakistan	• Pakistan Organic Farmers Association
Poland	• Agro Bio Test
Portugal	• SOCERT-Portugal Certifaçâo Ecológica • Ministerio da Agricultura, do Desenvolvimento Rural e das Pescas
Spain	• SEAD-Sociedad Española de Agricultura Ecológica • Ministerio de Agriultura Pesca y Alimentacion
Sweden	• The Biodynamic Research Institute • Ekologiska Lantbrukarna • Swedish Board of Agriculture
Switzerland	• Forschungsinstitut fur Biologischen Landbau (FIBL)
Turkey	• ETO-Ecological Agricultural Organisation
USA	• Rodale Institute

In order to assess the availability of organic seed elsewhere in Europe and from further afield, an e-mail survey was conducted by contacting the organisations listed above and asking the following questions:

- Do you have any information regarding the commercial availability of organically produced seed in your country or Europe as a whole?
- I am especially interested in obtaining names and addresses (postal and e-mail) of organic seed producers and the species/varieties of organic seed they produce. Do you have this sort of information?
- Are organic producers in your country aware of the EU Regulation (2092/91) regarding the end of the derogation period for use of non-organic seeds on organic farms?
- The derogation period ends on 31 December 2000, how do think organic producers in your country plan to meet this?
- What are the opinions of your country's organic certification bodies regarding genetically modified organisms in organic food and agriculture?
- Do you know of any survey similar to this one that is already being carried out? Please give details.

Where government or official departments were contacted, the following questions were asked:

- Could you make a statement on how organic seed is officially regarded in other European countries?
- For example, is there a shortage?
- Does the organic administration insist that it is used on organic farms?
- What are the official views regarding the derogation period for the use of conventional seed on organic farms?

ANNEX 3

Regulation in North America is considerably looser than that adopted in Europe, with a concomitant unavailability of organic seed. The supply of certified organic seed seems to be restricted to small companies that aim at the hobbyist or gardener, rather than the large commercial grower.

In Canada, there is no specific requirement to use organic seed. Farmers may use any seed "subject to the approval of a certification body". One grower said that "certified organic vegetable seed is not available in large volumes and the range of cultivars tends to be very limited" with a price premium of 20-25%. (A. McErlich, pers. comm.) This grower particularly wanted cultivars adapted to automated harvest and processing systems, and complained that the cultivars for which organic seed was available tended to be older and heirloom types.

In the United States matters are confused by distinct Federal and State accreditation systems. In general growers may use any seed, including that treated with any legal pesticide, provided they state that no organically produced seed was available. Some states do not permit the use of insecticidal seed dressings, others do. The only strict prohibition is against the use of genetically modified seed.

In New York, for example, NOFA-NY requires the use of untreated seed unless only treated is available. One respondent commented: "it is difficult to get untreated seed of many vegetable varieties, especially new or novelty varieties that are especially popular with customers of organic". (T. Bjorkman pers. comm.)

Organic seed was originally part of the proposed national standards developed by the National Organic Standards Bureau in the US (i.e. not the USDA proposed standards) but was not accepted into the USDA standards. The latest draft of the Organic Trade Association's American Organic Standards notes that "many comments were received that indicated a requirement for organic seed is premature at this time, and that treated seed should be eliminated before a requirement for organic seed can be implemented." Draft 3, section 1.6, released on 1 October 1999, thus considerably relaxes the requirement for organic seed of previous drafts. Organic seed is compulsory only for the production of sprouts. In all other circumstances seed that is "non-organic" to differing degrees is permitted. Growers must keep "records of all purchased seeds, including cover crops seeds, with documentation of attempts to source organic or untreated seeds, where applicable" but there is considerable leeway offered for the use of non-organic seeds in various circumstances. (Document available at www.ota.com)

Growers are supposed to be reducing their use of treated seed over time. For the foreseeable future, organic producers have no incentive to use organic produced seed as long as existing and anticipated federal and state laws allow them to use commercial, treated seed, which is often perceived as high quality. This is reflected in the comment of a supplier of an organically approved fungicide, who said that growers are happy to use seed pre-treated with captan or thiram "without regard for the biological alternative". (J. Meneley pers. comm.)

One consequence is that organic produce from North America is unlikely to meet European organic standards after the end of 2003, when the requirement for organic seed begins to bite. Another is that North America could be a large market for organic seed produced in Europe.

ANNEX 4

Cereals

Using data taken from the Soil Association which was extrapolated from 500 organic farmers (Soil Association, 1998), the proportions of land under the main cereal crops for 1997 in the UK are given in Table 1 Column B with the land areas they represent in column C (assuming that the main cereal crops are those given in column A). The approximate amount of seed required for each of these crops in 1997 (column D) was calculated using the seed rates given for these crops in the Organic Farm Management Handbook (Lampkin and Measures 1999). The estimates of yields from these crops was used to calculate the amount of land required (Column E) to produce the seed requirements in column D. The yield estimates for these crops were taken from Lampkin and Measures 1999.

Using the mean annual growth between 1993-97 (17.8%) the area of land under organic cereals in 2002 was obtained, from which the seed requirements for cereal crops were calculated (column F) assuming that the proportions of land under each of the crops have not changed since 1997. Moreover, the approximate land area required for commercial cereal seed crops in 2002 was also calculated using the guides given by Lampkin and Measures 1999 (column G). The same mean annual growth rate of 17.8% was also used to calculated the seed and land requirements for 2005 (column H & I). The growth rate data was taken from Foster and Lampkin (forthcoming).

Table 1. Calculations for forecasts of cereal seed use and production area.

A	B	C	D	E	F	G	H	I
Cereal crop	**Percentage of cereal land area for the UK in 1997**	**Approximate land area that the 1997 proportions in column B represent(ha)**	**Approximate amount of seed required for cereal production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column D (ha)**	**Approximate amount of seed required for cereal production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for cereal production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Barley	10%	504	96	26	217	58	355	95
Oats	23%	1199	261	64	592	146	967	239
Rye	3%	147	27	7	62	16	101	26
Spelt	2%	86	16	4	35	9	58	15
Triticale	4%	210	44	10	100	23	163	38
Wheat	59%	3090	695	174	1577	394	2578	645
Total	**100%**	**5236**	**1139**	**285**	**2583**	**647**	**4222**	**1058**

Cereals – Summary of information and assumptions used

- The proportions of land under the main cereal crops in 1997 were taken from Soil Association data extrapolated from 500 organic farmers (Soil Association, 1998).
- The figure used for the total amount of land under certified cereal crops in the UK was 5236 ha (Foster & Lampkin, forthcoming) and the amount of land under specific cereals was calculated using the proportions given in Soil Association (1998).
- The mean annual growth rate between 1993-97 (17.8% calculated with data from Foster & Lampkin, forthcoming, see figure 1a) of the area of land under organic cereals was used to obtain land areas under the cereal crops for 2002 and 2005 using 1997 as a datum.
- Seed requirements for the amounts of land under certain organic cereals for 1997, 2002 and 2005 were calculated by multiplying the figure of land area by typical sowing rates used for these crops given in Lampkin and Measures (1999).
- Land requirements for seed production corresponding to the seed requirements for 1997, 2002 and 2005 calculated, were obtained by dividing the seed requirement by the typical grain yields of these crops given in Lampkin and Measures (1999).
- Where spring and winter varieties of crops were specified, a mean of the two sowing rates and grain yields were used.

Vegetables

Using data taken from the Soil Association on estimated tonnage of production of various vegetable crops in 1997 (Soil Association, 1998), the area of land under a selection of vegetable crops for 1997 in the UK are given in Table 2 Column B. The selection of vegetables for this forecast was purely based on the available published data on the yields of seed crops. Other vegetables have been left out of the forecast due to a lack of this type of data. The approximate land area (column C) was calculated using the estimates of marketable yields given for these crops in the Organic Farm Management Handbook (Lampkin and Measures 1999) and from recommended seed rates given in commercial seed company catalogues. The approximate amount of seed required for each of these crops in 1997 (column D) was calculated using the seed rates given in the Organic Farm Management Handbook (Lampkin and Measures 1999) and from recommended seed rates given in commercial seed company catalogues. The estimates of yields from these crops was used to calculate the amount of land required (Column E) to produce the seed requirements in column D. The yield estimates for these crops were taken from Faulkner (undated).

Using the mean annual growth rate for the area under vegetable production in the UK between 1993-97 (26.5%) the area of land under each of the crops listed in column A in 2002 was obtained (Column E), from which the seed requirements for these vegetable crops were calculated (column F). Moreover, the approximate land area required for these vegetable seed crops in 2002 was also calculated

using the guides given by Lampkin and Measures 1999 (column G) and Faulkner (undated). The same mean annual growth rate of 26.5% was also used to calculate the seed and land requirements for 2005 (column H & I). The growth rate data was taken from Foster and Lampkin (forthcoming).

Table 2. Calculations for forecasts of vegetable seed use and production area.

A	B	C	D	E	F	G	H	I
Vegetable crop	**Estimated tonnage of vegetables harvested in the UK 1997**	**Approximate land area that the 1997 required for the production given in Column A(ha)**	**Approximate amount of seed required for the production of these vegetables in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column D (ha)**	**Approximate amount of seed required for production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for cereal production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Beans	500	45	2.102	0.530	6.810	1.718	13.785	3.477
Beetroot	500	25	0.175	0.127	0.567	0.412	1.148	0.835
Broccoli	500	50	0.010	0.004	0.032	0.013	0.066	0.027
Cabbage	6000	200	1.236	1.675	4.002	5.427	8.102	10.985
Carrots	1600	53	0.133	0.267	0.432	0.864	0.874	1.749
Onions	1000	38	0.173	0.446	0.561	1.445	1.135	2.925
Leeks	400	27	0.071	0.115	0.229	0.373	0.463	0.755
Parsnips	600	30	0.027	0.015	0.087	0.050	0.176	0.100
Peas	200	29	2.143	0.100	6.941	0.325	14.051	0.658
Potatoes	15000	698	2093	95	6780	308	13725	624
Swede	4000	160	0.160	0.976	0.518	3.162	1.049	6.400
Total	**30300**	**1355**	**2099.2**	**99.4**	**6800.132**	**321.967**	**13765.403**	**651.753**

Vegetables – Summary of information and assumptions used

- The area of land under organic vegetable crops for 1997 in the UK was calculated by dividing an estimated tonnage of production of various vegetable crops (Soil Association, 1998), by crop yield data from Lampkin and Measures (1999).

- The mean annual growth between 1993-97 (26.5% calculated with data from Foster & Lampkin, forthcoming, see figure 1a) of the area of land under organic vegetables was used to obtain land areas under certain vegetable crops for 2002 and 2005 using 1997 as a datum.

- Seed requirements for the amounts of land under certain organic vegetable crops for 1997, 2002 and 2005 were calculated by multiplying the figure for land area by typical sowing rates used for these crops given in Lampkin and Measures (1999) and from recommended seed rates given in commercial seed company catalogues.

- Land requirements for seed production corresponding to the seed requirements for 1997, 2002 and 2005 calculated, were obtained by dividing the seed requirement by the typical seed yields of these as seed crops given in Faulkner (undated) and by J. Cherfas (pers. comm.).

Grassland

Using 1997 data from SOPA & WIRS on areas of organic grassland managed by members of SA, SOPA, OF&G and BDA, estimates of grassland seed usages and future demands were calculated. Using the mean annual growth of grassland and fodder crops as given by Foster and Lampkin (forthcoming) between 1993-97 (50%) the area of land under organic grassland in 2002 was obtained, from which the seed requirements for grassland crops were calculated (column F) assuming that the proportions of land under each of the crops have not changed since 1997. Only the figures for temporary grassland areas were used because permanent grassland and rough grazing areas have little or no seed requirements in general. The area of temporary organic grassland in the UK in 1997 was 25533 ha and this was broken down into various grassland uses including cattle (beef and dairy) and sheep which are enterprises with predominantly grassland land uses. Cattle and sheep grazing were assigned 51% and 12% respectively. These proportions were taken from the OCIS data regarding types of enterprises undergoing conversion as an estimate of the likely breakdown of grassland use. These types of grassland were considered to be medium to long term leys. The remainder of the grassland was shared between other enterprises including pigs, poultry, mixed, horticultural, arable and others to represent the short term and conservation leys that would normally form part of the rotation in these systems. The mixtures of seed and their rates were taken from Lampkin and Measures (1999) in which four common short term ley mixtures were outlined. Assuming that any one of these seed mixtures could be used at any one time during a rotation, the area of temporary grassland remaining was divided by four and assumed to be occupied by one of each of the seed mixtures. Estimates of seed crop yield for each of these species was taken from a commercial grass/herbage seed producer and a researcher working with grass/herbage. A mean of the two estimates was used.

Table 3.1. Calculations for forecasts of grass seed use and production area: Cattle grazing mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for cattle grazing mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Perennial ryegrass	20.0	260	237	1978	1798	6675	6068
Timothy	7.5	98	217	742	1648	2503	5562
White clover	4.0	52	347	396	2637	1335	8900
Total mix	**31.5**	**410**	**801**	**3116**	**6083**	**10510**	**20530**

Table 3.2. Calculations for forecasts of grass seed use and production area: Sheep grazing mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for sheep grazing mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Perennial ryegrass	17.5	55	50	417	379	1409	1281
Meadow fescue	3.8	12	22	91	165	306	556
Cocksfoot	3.8	12	16	91	121	306	408
White clover	4.0	13	84	95	636	322	2146
Total mix	**29.1**	**91**	**172**	**694**	**1301**	**2343**	**4391**

Short term and conservation leys

Table 3.3. Calculations for forecasts of grass seed use and production area: Red clover mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for red clover mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Italian ryegrass	15	32	30	247	224	832	756
Red clover	10	22	51	164	387	555	1305
Total mix	**25**	**54**	**81**	**411**	**611**	**1387**	**2061**

Table 3.4. Calculations for forecasts of grass seed use and production area: Lucerne mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for lucerne mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Perennial ryegrass	10	22	20	164	149	555	504
Lucerne	20	43	82	329	626	1109	2113
Total mix	**30**	**65**	**102**	**493**	**775**	**1664**	**2617**

Table 3.5. Calculations for forecasts of grass seed use and production area: White clover mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for lucerne mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Perennial ryegrass	17	37	33	279	254	943	857
Timothy	5	11	24	82	183	277	616
Meadow fescue	2	4	8	33	60	111	202
White clover	4	9	58	66	438	222	1479
Total mix	**28**	**61**	**123**	**460**	**935**	**1553**	**3154**

Table 3.6. Calculations for forecasts of grass seed use and production area: Sainfoin mix

A	B	C	D	E	F	G	H
Grass/herbage legume crop	**Sowing rate for lucerne mix (kg/ha)**	**Approximate amount of seed required for grass/clover production in UK, 1997 (t)**	**Approximate area of land required for the seed production assumed in column C (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2002 (t)**	**Approximate area of land required for the seed production assumed for 2002 (ha)**	**Approximate amount of seed required for grass/clover production in UK, 2005 (t)**	**Approximate area of land required for the seed production assumed for 2005 (ha)**
Timothy	1.0	2	2	16	15	55	50
Meadow fescue	2.5	5	12	41	91	139	308
Sainfoin	62.0	134	244	1018	1852	3438	6252
Total mix	**65.5**	**141**	**258**	**1075**	**1958**	**3632**	**6610**

Grassland – Summary of information and assumptions used

- Estimates were given of areas of rough, permanent and temporary grassland in the UK from Scottish Organic Producers Association and the Welsh Institute for Rural Studies on areas of organic grassland managed by members of:
  - Soil Association,
  - Scottish Organic Producers Association,
  - Organic Farmers and Growers Ltd.
  - Bio-dynamic Association.

- Only the figures for temporary grassland areas were used because permanent grassland and rough grazing areas have little or no seed requirements in general.

- The area of temporary organic grassland in the UK in 1997 was 25533 ha and this was broken down into various grassland uses by using data from the Organic Conversion Information Service (EFRC) regarding types of enterprises undergoing conversion as an estimate of the likely breakdown of grassland use.

- Cattle (beef and dairy) and sheep grazing which are enterprises with predominantly grassland land uses were assigned 51% and 12% respectively. These types of grassland used were considered to be medium to long term leys and the seed mixtures outlined in Lampkin and Measures (1999) for cattle and sheep grazing were used to calculate seed requirements.

- The remainder of the grassland (37%) was shared between other enterprises including pigs, poultry, mixed, horticultural, arable and others to represent the short term and conservation leys that would normally form part of the rotation in these systems.

- Four different short term and conservation ley mixtures are given in Lampkin and Measures (1999). Assuming that any one of these seed mixtures could be used at any one time during a rotation, the area of temporary grassland remaining was divided by four and assumed to be occupied by one of each of the seed mixtures.

- The mean annual growth between 1993-97 (50% calculated with data from Foster & Lampkin, forthcoming, see figure 1b) of the area of land under organic grassland and fodder crops was used to obtain land areas under temporary grassland for 2002 and 2005 using 1997 as a datum.

- Seed requirements for the amounts of land under the different grassland mixtures for 1997, 2002 and 2005 were calculated by multiplying the figure of land area by the mixture rates given in Lampkin and Measures (1999). The seed requirements for individual species were added together for all mixtures and are presented in Table 2. Tables showing the calculations made for the individual mixes are given in Annex 4.

- Estimates of seed crop yield for each of these species were taken from a commercial grass/herbage seed producer and a researcher working with grass/herbage. A mean of the two estimates was used to calculate the land requirement for seed production for the individual species as a sum of all mixtures considered (Table 3). Tables showing the calculations made for the individual mixes are given in Annex 4.

- It was assumed that during 1997, 2002 and 2005, all grassland was totally re-seeded.

ANNEX 5

Table 1. UK seed companies contacted as part of the survey to identify problems associated with organic seed production

Seed Company	Address
1. British Seed Houses Ltd.	Portview Rd Avonmouth Bristol BS11 9JH
2. G Burlingham and Sons Ltd	Malting Lane Ingham IP31 1NB
3. Cotswold Seeds Ltd	The Barn Business Centre Great Rissington Cheltenham Gloucestershire GL54 2BR
4. John Ebbage Seeds Ltd.	The Stables Bexwell Road Downham Market Norfolk PE38 9NA
5. Elsoms Seed Ltd.	Spalding Lincolnshire PE11 1QG
6. Enterprise Seeds Ltd.	Little Hail Sleaford Lincolnshire NG34 9BG
7. Gleadell Banks	Lindsey House Hemswell Cliff Gainsborough Lincs DN 21 5TH
8. Leary's Seed Potatoes (current organic seed producer)	Bindon Home Farm Langford Budville Wellington Somerset
9. Nickerson-Zwann	Joseph Nickerson Research Centre Rothwell Market Rasen Lincolnshire LN7 6DT
10. Novartis Seeds	Docking Kings's Lynn Norfolk PE31 8LY
11. Pro-Veg Seed	6 Shinglay Lane Sawston Cambridge CB2 4SS
12. Saxon Agriculture Ltd.	Abbey Farm Church Road East Walton Kings Lynn Norfolk PE32 1PP
13. A.L. Tozer Ltd.	Pyports Downside Bridge Road Cobham Surrey KT11 3EH
14. Wyartt Seeds Ltd.	Stone Cottage Beyton Bury St Edmonds Suffolk IP30 9AF

Table 2. European organisations contacted as part of the survey to identify problems and research associated with organic seed production

Organisation	Address
1) Institute of Biodynamic Farming (Institut für Biologisch-Dynamische Forschung)	Zweigstelle Dottenfelder Hof Holzhausenweg 7 D-61118 Bad Vilbel Germany
2) Institute of Organic Agriculture, University of Bonn (Institut für Organischen Landbau, Universität Bonn)	Katzenburgweg 3 D-53115 Bonn Germany
3) Rijk Zwaan Seed company (Rijk Zwaan Zaadteelt en Zaadhandel B.V.)	PO Box 40 2678 ZG De Lier The Netherlands

In order to assess the availability of organic seed and the perceived problems associated with production the following (appropriate) questions were asked during telephone conversations and visits:

A For producers/breeders;

1 Do you produce organic seed or are you planning to?
2 Is your seed certified organic? If so, by which certification body?
3 Could you please send me a catalogue with the species and varieties you currently produce?
4 When did you start producing organic seed?
5 Who do you mainly sell to Farmers, Growers, gardeners or others? (Rank by volume/percentage of main markets).
6 What is the scale of production? (i.e. average order or pack size?)
7 What do you see are the main difficulties or obstacles in organic seed production?
8 Do these relate to the production of particular varieties? If so, which?
9 What methods do you use to measure seed quality?
10 How do you prevent/control fungal diseases?
11 How do you ensure seed vigour and longevity?
12 Do you supply other countries with seed? If so what species/varieties are exported?
13 In your opinion are there any areas in organic seed production e.g. technical or marketing related or other, that you feel needs to be addressed to increase the production and commercial availability of organic seed?
14 Do you plan to expand the number of varieties you produce? If so, how many and which varieties?
15 Are you interested in getting involved with organic plant breeding?
16 How many varieties do you expect to have commercially available by Dec 2000?
17 Do you know of anyone else producing organic seed or are planning to? If so, who?

B For people planning to produce/breed;

1 If you are planning to produce organic seed, then when?
2 What made you decide to produce organic seed?
3 What varieties do you plan to produce?
4 What do you see are the major obstacles in producing seed organically?
5 Do these problems relate to certain varieties? If so, which?
6 Do you know of anyone else producing organic seed or are planning to? If so, would you share your list with me?

The responses to these questions have not been tabulated as these questions were used only to guide the interviews.

ANNEX 6

A selection of previous research carried out on disease control for organic farming systems

ADAS (1991) carried out a survey of disease incidence in organic versus conventional wheat. They found that in many cases the incidence of disease in organic wheat was less than or approximately the same as for conventional wheat.

Research has been done at the Institute of Bio-dynamic Farming on other types of seed treatment such as horse-radish extract as a seed dressing which was found to be effective in controlling common bunt (*Tilletia caries*) in wheat to an effectiveness level of 99.8% (Spieß & Dutschke, 1991). Spieß & Dutschke (1991) also found that soil treatments using liquid manure, calcified seaweed and wood ash also offered effective control for bunt.

Other studies at the Scottish Agricultural College have shown that exposing seed potatoes to light, can increase tuber resistance to diseases like *Fusarium* spp, and blight (Farmers Weekly, 2 April 1999).

Much work has been carried out on organic cereal seed quality at the Institute of Organic Agriculture at the University of Bonn in Germany. One of the main findings has been that seed size was found to be one of the main factors in determining seed quality with regard to disease. They found that wheat seeds greater the 2.5 mm in diameter were less likely to succumb to fungal attack from diseases like *Septoria nodorum* (causes leaf blotch) and *Fusarium* spp. (Piorr, 1991). Moreover, these larger seeds resulted in increased emergence percentages and larger seedlings. The Institute of Organic Agriculture recommends that cereal seed is graded to gain grains of greater than 2.5 mm. This is due to the fact that disease in the ear of a cereal plant, can cause the grains to become smaller, therefore, by selecting larger grains, a lot of disease can be avoided because larger grains tend to come from healthy plants. This type of grading method could be used by UK organic seed producers as a way of reducing disease in cereal seeds.

Further work at the Institute of Organic Agriculture showed that *Fusarium* spp. could be reduced in cereals by storing the seed for a year before planting (Köpke, personal communication). A study had shown infestation of *Fusarium* spp. was 11% for seed sown in the same year as harvest but only 4.2% for the same varieties but sown after one year in storage. This difference was probably due to antagonists growing on the stored grain and surrounding it forming a natural seed treatment that reduces certain diseases.

Much of the research that has taken place on disease control for organic systems shows that there is the potential to develop alternative technologies to make them commercially viable. Further work is needed to find ways of controlling disease and to investigate methods that may already be in use for organic seed production.