Choice of cereal and pulse species and varieties

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CEREALS

All the main cereal crops - wheat, barley and oats, triticale, rye and spelt - can be grown organically in the UK. The areas of different cereals grown in the UK in 1998 and 1999 are given in Table 1. The total area of cereals is expected to more than double by 2002 (Taylor *et al.*, 2001).

Table 1. UK organic cereal area (ha) 1998 and 1999 (Soil Association, 2001)

	1998	**1999**
Wheat	4163	4320
Barley	1005	1200
Oats	1949	1900
Triticale	324	500
Rye	147	200
Spelt	61	100
Total	7649	8220

Until recently, the most important organic cereals were wheat and oats, with premiums paid for samples which reached milling quality. In the last year or two, more livestock farmers than arable farmers have converted to organic production so that feed grain has been in short supply, and the range of cereals grown organically has increased. New markets have also developed. Malted organic barley has been used for some time to produce beer, and now barley malt and wheat have been processed into organic whisky.

Organic growers may use different criteria to those of conventional growers when selecting which cereal to grow. Important considerations include available markets, soil type, the preferred time of sowing, ability to compete with weeds, disease resistance, and rotational position, particularly in relation to nitrogen supply. Winter cereals yield more and are harvested earlier than spring cereals but are unlikely to take up all the mineralised N available in autumn (Watson, 1993). Where spring cereals are grown, land should not be ploughed until late winter in order to minimise leaching of mineralised nitrogen. Spring-sown cereals have a lower nutrient demand, are less exposed to weed competition because of their shorter growing period, and are more suitable for undersowing with grass/clover or clover. The pattern of soil nitrogen release corresponds better to the nitrogen demands of spring cereals than winter cereals. However, on more nutrient retentive soils such as silty clay loams, where winter leaching of nitrogen is lower, this is less of a concern and winter-sown cereals will generally yield more. These heavier soils are also less suited to spring cropping particularly in drier eastern areas where establishment can be poor resulting in uncompetitive crops with a lot of weeds. Spring cereals in these areas are best limited to the end of the rotation for undersowing. The ability to compete with weeds is greater in oats and triticale than in barley, and least in modern wheat varieties (Welsh *et al.*, 2001). As a result, oats and triticale may be less well suited to undersowing, particularly in high-fertility situations.

Organic wheat is grown for feed and for milling for bread, biscuits and flour. Current prices are distorted by the shortage of UK-grown feed grains. Feed wheat sells for as much as £185/tonne while the best high-protein milling samples can attract prices of over £195/tonne (Barrington *et al*, 2001). Protein standards are particularly difficult to achieve with organically grown wheat, a reflection of the lower nitrogen supply, particularly later in growth, compared with non-organic crops. Winter wheat is potentially the highest yielding cereal for organic situations and is often the most suitable cereal to follow a fertility-building phase in the rotation. In the most favourable situations, i.e. with adequate nitrogen supply, yields of over 8.0 t/ha can be achieved (Cormack, 1997). Spring wheats do not yield as well as winter varieties but are generally higher quality. In northern areas of the UK, spring wheat does not mature until mid or late September when adverse weather conditions can reduce grain quality. Where winter conditions are not likely to be severe, some varieties of spring wheat, e.g. Axona, sown in November, will give higher grain protein contents than true winter varieties but yields are likely to be less. Spring varieties tiller less than winter varieties and are less able to compete with weeds.

Barley is earlier to mature and with a greater tillering capacity, competes better with weeds than wheat, but it generally yields less. Organically grown barley is mainly used for animal feed but smaller amounts are malted or processed for human consumption. Yield can range from 2.5 to 6.0 t/ha depending principally, as for wheat, on the effects of soil type and rotational position on nitrogen supply. Contracts for malting barley are available with the market generally under supplied. There is less experience of organic winter barley than spring barley in the UK. Winter barley has the advantage that the ground is ploughed and worked when soil conditions are generally more favourable, and mineralised nitrogen is available to assist crop establishment. Disadvantages of autumn sowing are a greater risk from BYDV if the crop is established early or is sown after a ley, and a high susceptibility of many varieties to at least one commonly occurring disease. Winter barley is sown earlier than other winter cereals and is more exposed to weed competition than spring barley. Since barley yield depends more than in other cereals on adequate tillering and ear numbers, soil nitrogen availability in early spring is critical; organic growers may have to apply manures to meet this demand. Spring barley, on the other hand, is generally less affected by disease. It has the disadvantage of being very sensitive to adverse soil conditions caused by cultivations in the winter or spring when conditions are wet. However, spring barley provides more opportunity for weed control cultivations before sowing because of the longer time available. This is especially true for grass weeds such as couch.

Organic oats can be grown for feed or milling for which there is an additional premium although the market is smaller than for wheat or barley. Oats have a lower nitrogen requirement than wheat or barley and should not be grown in high fertility situations because of the risk of lodging and late ripening. High soil fertility can be exploited better by crops such as wheat, potatoes or brassicas. A crop of oats is a good competitor with weeds and this can be used to good effect following a crop that is a poor competitor, for example swedes or carrots. Oats might also follow wheat or barley. Spring oats can be undersown with a grass/clover mixture when it is usually necessary to reduce the seed rate. Winter oats are sown at about the same time as winter barley and like winter barley are susceptible to BYDV. They are less winter hardy than other winter cereals and should not be sown on exposed northerly sites. Although susceptible to weed competition in the early stages, winter oats are long-strawed and compete well with weeds. However, lodging can be a problem and highly fertile sites such as after grass/clover leys should be avoided.

Triticale is a useful crop for organic systems. It has long straw, making it competitive against weeds, good disease resistance, and a greater tolerance of drought than wheat. Furthermore, it appears to be less palatable to rabbits than other cereals. Triticale performs relatively well under conditions of low fertility which makes it more suitable as a second cereal than winter wheat. The price of triticale is competitive with other organic cereals grown as feed grain. Although only winter varieties exist it is possible to plant triticale through to the end of January/early February if soil conditions allow.

Spelt is an old cereal with new interest. It is winter-sown and can perform well in severe conditions though not necessarily in poor environments. It shows good disease resistance and competes well with weeds. The harvested grain requires special milling to remove the hull. There is a very limited market and crops should only be grown under contract.

Constraints imposed by crop-specific fertiliser and chemical applications on the use of crop species mixtures (mixed crops, alternate rows, alternate strips) that limit their application in non-organic situations, do not apply on organic farms. Crop species mixtures may have a number of advantages in organic farming including reductions in pest and disease levels, improved weed control and provision of nitrogen where legumes are used in continuous systems. Wheat and beans do not compete for nitrogen when grown together such that higher protein levels may be achieved in wheat grown with beans than in wheat alone (Bulson *et al.*, 1997).

Cereal varieties

Information on cereal varieties is available from various sources including NIAB, SAC, DARD, the advisory services, merchants, end-users and the trade. Detailed comparative information is contained in the NIAB Cereals Variety Handbook, the SAC Cereal Recommended List and the DARD List of Cereal Recommended Varieties for Northern Ireland. These publications include comparisons of varieties grown without fungicides and plant growth regulators rather than under organic conditions. They do provide some guide to performance under organic cultivation but need to be used with care, principally as the trial plots are grown with a non-limiting nutrient supply. In contrast, most organic systems have a much lower nutrient availability, particularly of nitrogen which is the main driver of yield and which also interacts with weed and disease levels. Since 2000 harvest, three series of organic variety trials are underway; by NIAB funded by plant breeders, by Elm Farm Research Centre and by Arable Research Centres funded by HGCA as project 2237. Results from the 2000 NIAB trials were included in the 2001 Cereals Variety Handbook (NIAB, 2000a).

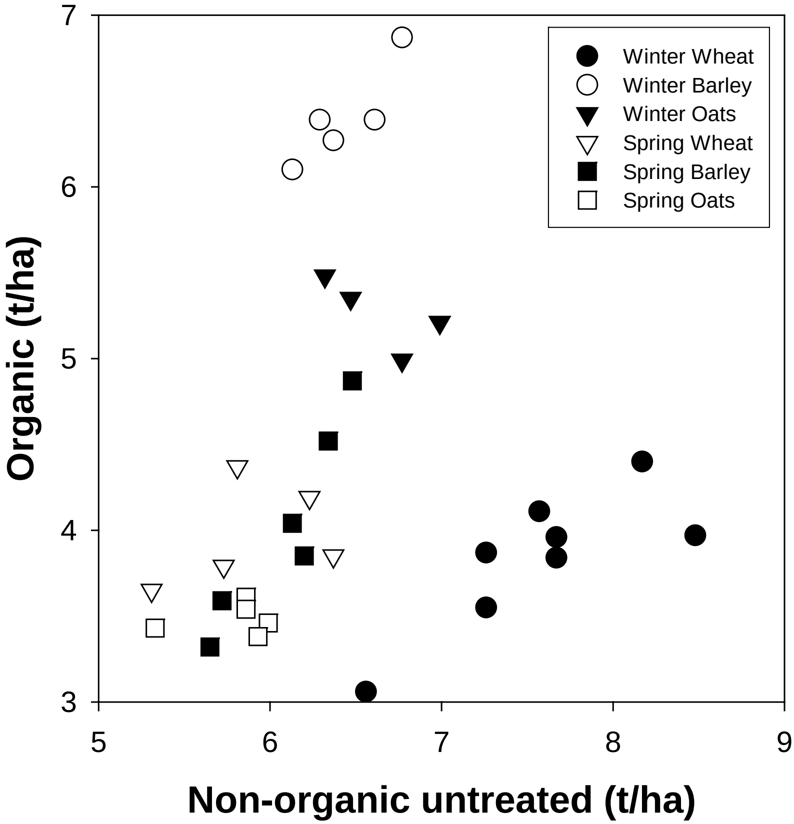
Variety probably has less influence on cereal yield and profitability in organic compared with non-organic situations due to the greater variation in nutrient availability, and weed, pest and disease levels in organic systems. Organic growers may be expected to use different criteria to those used by conventional growers when selecting cereal varieties, and there is evidence that the best performing conventional varieties do not always transfer well to organic systems (Fenwick, 2000). For organic systems, growers should choose varieties that perform well in trials on organic farms. However, as this data remains very limited, the alternative is to use the untreated controls in non-organic trials as a guide. Regressions of variety yields in one year's organic trials on the yields of the same varieties in long-term non-organic untreated trials published by NIAB (2000a), show significant positive relationships for winter wheat and spring and winter barley, but little evidence of yield correlations for spring wheat or spring oats, and a possible negative relationship for winter oats (Figure 1). In general, choose varieties with a high grain yield, with high scores for resistance to appropriate diseases, and with long straw since this may confer good competitive ability against weeds, especially in the less competitive cereals such as wheat. Other characteristics are important for specific markets, locations and farm situations. Malting and milling markets require specific varieties, good straw strength is important where a crop is to be grown after a long grass/clover ley, resistance to ear-loss is important in exposed fields, and early maturity reduces harvesting risks in northerly and upland situations.

For premium markets, selection of an appropriate variety is essential. Conventional bread-milling varieties of wheat can achieve acceptable grain quality under organic conditions, but in most cases protein content at 9% to 10% will be significantly lower than non-organic expectations. The choice of varieties for this market is limited but high grain protein and Hagberg Falling Number (HFN) are essential. Similarly, variety choice might be influenced by level of screenings in malting barley, and specific weight where feed grain is intended for sale. This is dealt with elsewhere in this publication.

One variety is rarely the obvious best choice for any given situation and growers have to weigh strengths and weaknesses for different characters. For example, when comparing bread-milling winter wheat varieties, Hereward has longer straw and higher grain protein but lower HFN, and is more at risk from mildew and yellow rust, whilst Malacca has better foliar disease resistance and HFN, but lower grain protein and specific weight, and shorter straw. (Table 2).

Figure 1. Comparison of cereal yields in 2000 from one year's organic and long-term non-organic trials untreated with pesticides or growth regulators (for cultivars common to both trial series).

Organic Cereals and Pulses



(source: NIAB 2000a)

If, in future, breeders cannot guarantee their material free from genetically manipulated parents, the choice of varieties for organic growers will become very limited, encouraging the development of breeding programmes dedicated to organic varieties. It is probable that such varieties will be selected for different criteria to those for which conventional varieties are selected under conditions of high fertiliser and agrochemical inputs. Whilst some desirable characteristics are common to varieties under both systems, e.g. disease resistance, selection criteria for varieties to be grown under organic conditions might include objectives not thought relevant to non-organic systems. This could include competition with weeds, resistance to a different range of pests and diseases, the ability to perform in crop mixtures, or the ability to make better use of lower levels of soil nitrogen.

Table 2. Characteristics of winter wheat varieties grown in a non-organic situation (from NIAB, 2000a)

	Hereward	**Malacca**
Untreated yield (% of treated controls)	72	72
Shortness of straw	7	8
Resistance to mildew	6	7
Resistance to yellow rust	7	9
Resistance to brown rust	8	8
Resistance to *Septoria nodorum*	7	7
Resistance to *Septoria tritici*	6	6
Protein content (%)	13.2	12.3
Hagberg Falling Number	267	346
Specific weight (kg/hl)	79.2	75.9

It is not appropriate to reproduce here tables of recommended varieties for the range of cereal species grown in the UK. However, examples of cereal varieties suitable for organic rotations, with the criteria used in their selection are shown in Table 3. The list is by no means exhaustive and growers must decide which criteria to use in their own situations. Other varieties may be more suitable in specific situations.

Table 3. Examples of cereal varieties for organic rotations

Cereal	Market	Variety	Characteristics
Winter wheat	Feed	Deben	Good resistance to yellow rust and *Septoria*, high untreated and organic yield, tall straw but rather weak, and below average resistance to mildew.
Winter wheat	Bread-milling	Hereward	Longer straw than other main bread-milling varieties, but good straw strength. Reasonable disease resistance. High protein but lower HFN and lower yield than other recommended varieties in untreated trials.
Spring wheat	Bread-milling	Paragon	Good bread-making quality and disease resistance. Long straw of average strength. High untreated yield in untreated trials but lower yield than Chablis in organic trials
Winter oats	Milling	Kingfisher	Long straw, good disease resistance and large grain. Early ripening and high yield, but some lodging risk.
Spring oats	Milling	Firth	High untreated yield, good mildew resistance and straw strength, but shorter than average
Winter barley	Feed	Pearl	Long, strong straw and bold grain with good yield and disease resistance, but later than average.
Spring barley	Malting	Chariot	Long straw, good mildew resistance and relatively early, but susceptible to *Rhynchosporium.* Well-tried variety but yield is below average.
Spring barley	Feed	Riviera	Tall stiff, straw. Large grain, good resistance to mildew and average resistance to *Rhynchosporium*. Good yield.
Triticale	Feed	Ego	Tall, stiff-strawed with high yield potential and good specific weight

There are a number of traditional varieties used in organic farming, of which the winter wheat Maris Widgeon is a good example. Maris Widgeon can give good hard-milling samples although the HFN is not as high as that of modern milling varieties. It has long straw which commands a premium for thatching if handled carefully (this may mean harvesting by binder!). Until recently there was little information to compare Maris Widgeon with modern varieties of winter wheat but trials in 2000 conducted by the Arable Research Centres and Elm Farm Research Centre indicated that yields (4.0-4.9 t/ha) are comparable to modern varieties under organic conditions.

For organic growers, variety mixtures offer a number of positive benefits over single varieties. Varieties suitable for inclusion in mixtures may be different to those suitable for use in pure stands. Mixtures are considered elsewhere in this publication.

PULSES

Pulses are legume seeds, normally sown as field crops and harvested by combine harvester. The range of species grown in the UK includes winter and spring varieties of field beans (*Vicia faba*), peas (*Pisum sativa*), lupins (*Lupinus* spp.), and specialised crops such as lentils (*Lens esculenta*) and soya beans (*Glycine max*). Peas and beans are the most commonly grown pulses in the UK. In 1999 there were 200 ha of peas and 680 ha of field beans grown organically in the UK (Soil Association, 2001); organic peas and field beans are currently worth £220/t and £210/t respectively (Barrington *et al*, 2001).

The main use of pulses is as a source of animal feed protein and energy, although peas, and to a lesser extent beans, may be used for human consumption. Interest in protein crops increases when the supplies of imported soya are threatened or, as recently, cannot be guaranteed free of genetically modified material.

A comparison of the nutritive values of pulses is given in Table 4. Beans have a higher protein content than peas and are similar in energy value. Recent interest in lupins has been stimulated by their high protein content and feed value which is comparable to soya (Acamovic, 2001).

Table 4: Comparative nutritive values of pulses (from Ewing, 1997)

	Dry matter (%)	Crude protein (%)	Digestible crude protein (%)	ME - ruminants	ME - poultry
Beans	86.0	29.0	26.0	14.0	13.5
Peas	86.0	26.0	23.0	13.6	13,0
Lupin flakes	86.0	32.0	28.0	14.5	11.0

Pulse yields do not depend on applied nitrogen as manure or fertiliser. As in all legumes, nitrogen is supplied from root nodules in which *Rhizobium* spp. bacteria convert soil atmospheric nitrogen into a form usable by the plant. The amount of N fixed in the roots of grain legumes has been estimated at 150-200 kg/ha, most of which is removed in the grain of the crop (Fisher, 1996). Because soil organic matter break-down and nitrate mineralisation continue during crop growth, there remains a residue of N in the soil, greater than after non-legumes. This is equivalent to 40-50 kg/ha N, and is an important contribution to maintaining soil fertility in organic systems, particularly in stockless rotations (Cormack, 1997).

Field beans may be autumn (winter) or spring sown. Winter beans have large seed (500-600g/1000) and are sown from late October to mid November in the UK. Winter beans can be sown to a depth of 8 to 10 cm but establishment can be conveniently done by broadcasting and ploughing-in the seed to a depth of 12 to 15 cm in order to establish about 25 plants/m^2 (Lampkin and Measures, 2001). Spring beans should be sown as soon as soil conditions allow in February or March, although later sowings, up to early April, can still give acceptable yields. They have smaller seed (350-500g/1000) and the target plant population is 40-50 plants/m^2. Spring beans are sometimes regarded as a risky crop, requiring a dry period for sowing in February/March followed by wetter conditions for germination, adequate moisture for growth, and a dry late summer for ripening and harvest. They branch less than winter beans and in order to achieve a rapid, uniform establishment they should be sown and not ploughed in (Knott *et al.*, 1994). The relatively large seed of both winter and spring beans may require modifications to the seed drill, such as special feed wheels, to avoid cracking the seed.

Beans are relatively slow to emerge despite their large seed size. This, and the low densities at which they are sown compared to other arable crops, leaves bean crops open to potentially damaging weed competition in the early stages of growth. Using a harrow comb on the emerged crop may be possible or the crop may be sown in wide rows to allow inter-row cultivations (Rasmussen *et al.*, 2000).

Field beans are normally harvested later than cereals. Winter-sown varieties mature earlier than spring varieties in southern parts of the UK and may be harvested from early/mid August onwards, but where adequate moisture is available to maintain slower growth in northern areas harvest may be delayed until mid or late October, making winter beans an unsuitable choice for Scotland (SAC, 2000). Spring varieties reach maturity in late August or early September in the southern UK, but a month later in the north, where they are combined before winter beans. Unlike combining peas, field beans generally remain standing until harvest; they are less affected by wet weather and less likely to shed than peas if harvest is delayed. Yields of non-organic winter beans may be above those of spring beans in the south (NIAB, 2000b) but are unlikely to exceed spring beans in the north. Since winter beans are also more likely to suffer from the chocolate spot disease than spring beans (Knott *et al.*, 1994), there would appear to be little advantage in organic situations from winter beans which provide very little winter ground cover against erosion, weed development or nutrient loss.

Combining peas are less common than field beans in organic rotations, mainly due to concerns about lodging and weed control. Peas may be autumn or spring-sown, although at present the winter crop is not well developed in the UK. Spring combining peas are sown in March or early April. Seed size varies from 150 to 350g/1000 seeds, and seed is normally sown with a cereal drill to establish 60 to 90 plants/m^2 (Biddle *et al.*, 1988).

Because peas may lodge severely, allowing weed growth in the crop before harvest, good weed control is essential under organic conditions where pre-harvest chemical desiccation is not possible. Peas, like beans, are relatively widely spaced, are slow to emerge, and are not good at suppressing early weed growth. Weed control in winter peas may be especially difficult since soil conditions after sowing are unlikely to be suitable for mechanical weeding. In spring, mechanical methods of weed control such as cultivation with a harrow comb in the emerged crop may be successful, although limited evidence is available from the UK. Wherever possible, combining peas should be sown in fields where weeds are not a problem. Other cultural methods of weed control, such as increased seed rate, will reduce early competition from weeds, but may exacerbate crop lodging (Taylor *et al.*, 1991). In favourable areas spring varieties are harvested in August; three to four weeks earlier than field beans. Under conventional conditions yields are similar from spring and winter sown combining pea crops, and may be expected to exceed those from beans.

Lupins are a minor crop in the UK. Past attempts to grow lupins in the UK have resulted in extremely late harvests (after Christmas not being unusual) but more determinate varieties are now on offer. Lupin species differ in flower colour and leaf type: white (*Lupinus albus*), yellow (*Lupinus luteus*) and blue or narrow-leaved (*Lupinus angustifolius*). Varieties are available for winter and spring sowing although the areas most suited to each have yet to be determined in practice. Lupins prefer more acidic soils than those suited to peas or beans, normally below about pH 6, and this, coupled with an ability of some lupin species to take up phosphorus efficiently, may make them adapted to low-fertility sites.

Winter lupins are sown in late August or early September and the stage of crop development reached before winter is critical for winter survival (Shield *et al.*, 2000). Spring lupins are sown in March or April. The aim is to establish 28-30 plants/m^2 for winter lupins and 90-100 plant/m^2 for spring lupins (Impey, 2001); seed should be inoculated with *Bradyrhizobium* spp. immediately before sowing. Neither winter nor spring lupins are very competitive with weeds and the comparatively early sowing date of the winter crop is very likely to require autumn weed control. Lupins remain standing until harvest and late weed development is less of a problem than in peas.

Grain yields from lupins are reported to be from 2 to 4 t/ha. Harvest dates range from mid August for spring-sown narrow-leaved varieties in the south of England (Anon, 2001), to October onwards for spring-sown white lupins in northern Scotland. In trials at three sites in the southern UK winter varieties were harvested after spring types and were taller and higher yielding (NIAB, 2000b). Winter lupins are unlikely to be suitable for Scotland. There is no established market for lupins though the quality of the crop would indicate that it could be more valuable than peas or beans.

Pulse varieties

A recommended list of combining pea and field bean varieties is published by NIAB (2000b) and includes data from lupin trials. SAC (2000) publishes an annual list of recommended combining pea varieties. Data in these lists is from trials carried out under non-organic conditions.

Field beans differ in seed yield, plant height, ripening date, resistance to lodging and disease, seed size and protein content, and flower colour (indicating seed tannin content). Four winter and twelve spring bean varieties are recommended by NIAB for 2001. These include the white-flowered varieties Silver (winter- sown), Alpine and Avon.

Although tannin-free (white-flowered) beans may be fed to monogastric animals at higher rates than beans containing tannin, there is no additional premium for them whether non-organic or organically produced. Not only are white-flowered varieties reputed to have thinner seed coats than other varieties (Bulson, 1993), but tannin is also thought to act as a natural fungicide which protects the germinating seed from soil-borne diseases (e.g. *Fusarium* spp.), so that tannin-free varieties may show poor establishment under organic conditions; this does not appear to be the case in non-organic crops (Knott *et al.*, 1994). Since white-flowered varieties also tend to be short, organic growers have no reason to choose these instead of coloured-flowered varieties.

The most important considerations for organic growers in the choice of field bean varieties are straw height, earliness of ripening, disease resistance and yield. As in other organic crops, yield will be more influenced by growing conditions than by variety and organic growers should select for agronomic characteristics before yield.

Earliness of ripening is more important in beans than in many other crops. Late maturing varieties are harvested in cooler weather when drying of the crop in the field is slow. Normally beans stand well, and although brackling may occur it is unlikely to result in seed loss. Pod splitting and bird damage only occur if harvest is delayed considerably. On heavy soils, late maturing varieties increase the chance of damage to soil structure from heavy harvesting machinery as soils become wet in autumn.

Tall varieties compete better with weeds than short varieties. Although early crop vigour is the most important feature in competition with weeds, final height gives an indication of competitive ability. The recommended lists of field bean varieties suggest an inverse relationship between final straw height and earliness in beans which may be because of the indeterminate growth habit, so variety choice is a compromise. If harvested in good condition bean straw can be baled and used for bedding or feed, and has a higher feed value than wheat straw (Knott *et al.*, 1994).

Diseases of field beans include chocolate spot (*Botrytis fabae* and *B.cinerea*), downy mildew (*Peronospora viciae*) and *Ascochyta* leaf and pod spot (*Ascochyta fabae*). The most likely of these to trouble organic crops is chocolate spot which cannot be controlled by rotation. Chocolate spot is influenced by season and location and affects winter beans more than spring beans. Comparative data for this disease is not available, though casual observations suggest that there are differences between varieties. Downy mildew should not be a problem where a good rotation is practiced and resistant varieties are used. *Ascochyta* is controlled through seed health standards.

Varieties of combining peas can be grouped by seed and flower colour, leaf type and sowing time. The majority of combining peas are spring-sown. Coloured-flowered varieties are grown for forage and produce brown seeds with a specialised market for pigeon feed. Almost all modern pea varieties are semi-leafless and, compared to normal-leaved peas, have larger stipules and the leaflets replaced by tendrils so that plants bind together more. Semi-leafless peas may be less competitive with weeds than normal-leaved peas (Greven, 2000). Seed colour and type determine the end use. Marrowfats and some blue peas are suitable for human consumption, large blues can be used in pet foods after micronising (treatment with infrared radiation to improve digestibility), and white-seeded peas are mostly used in animal feed compounding.

Factors in varietal choice for combining peas include seed colour, straw length, earliness of ripening and disease resistance. Peas frequently lodge severely before harvest so resistance to lodging and ease of combining are also important; semi-leafless varieties lodge later and less completely than normal-leaved varieties. This has implications for how fast the crop dries in the field, how readily weeds grow through the lodged crop and how easily the crop can be combined. Straw height is not necessarily associated with susceptibility to lodging, and analysis of SAC data indicates a positive correlation for straw strength and plant height (unpublished data). Tall varieties such as Eiffel and Nitouche will compete more effectively with weeds than shorter ones such as Elan or Croma.

The main diseases for growers of organic combining peas to consider are downy mildew (P*eronospora viciae*), leaf and pod spots (*Ascochyta pisi*, *Mycosphaerella pinoides* and *Phoma medicaginis*), botrytis (*Botrytis cinerea*), and pea bacterial blight (*Pseudomonas syringae*). Downy mildew is potentially a serious disease of pea crops. It is soil borne and may be avoided by rotations which allow four years between pea crops and by using resistant varieties. Botrytis affects peas after flowering, and is most serious in humid weather. There is evidence from Scottish trials of small varietal differences in resistance to botrytis (SAC, 2000).

Date of ripening in peas is important in northern areas and Scotland. Differences in maturity of a few days in the south are multiplied three or four times in the north. Only relatively early varieties of combining peas are recommended in Scotland. Delays in harvest under organic conditions, especially where weeds are not completely eliminated, can lead to slow combining, damage to machinery, and a wet, discoloured sample, with a high admixture.

Yields from lupin variety trials can be found in NIAB (2000b). In NIAB trials, winter varieties were harvested later than spring varieties and were taller and higher yielding. For both spring and winter lupins tall varieties with early maturity are to be preferred in organic rotations. Some spring varieties are extremely short and therefore unsuitable for organic production.

In the absence of organically managed trials on pulse crops, selections for organic rotations have to be based on data from non-organic trials. Some varietal selections are given in Table 5. Once again, growers may not consider the criteria used in selecting these to be appropriate for their own situations and should base their selections on their own criteria.

Table 5. Examples of pulse varieties for organic rotations

Crop	Region	Variety	Characteristics
Winter beans	England	Clipper	Tall straw, good disease resistance and high yield. Later than some varieties so unlikely to suit northern areas. Coloured flowers.
Spring beans	England	Lobo	Fairly tall, strong straw and earlier-than-average maturity, but below average resistance to disease. Coloured flowers.
Spring beans	Scotland	Victor	Early maturity, shorter-than-average but stiff straw. Average yield. Weak on downy mildew. Coloured flowers.
Spring peas	England	Nitouche	Tall, strong straw with good ease of combining. Average maturity. Good yield in conventional trials and good resistance to downy mildew. Large blue seed.
Spring peas	Scotland	Eiffel	Early. Tall, stiff straw with good ease of combining. Below average yield in conventional trials and risk of downy mildew. White seed.

ORGANICALLY GROWN SEED

UKROFS, and hence all UK certification bodies, require that growers have a derogation before purchasing and planting seed of non-organic origin. The commercial production of organically grown seed is in its infancy and the range of varieties available is currently limited, therefore to secure the most appropriate cultivars it is essential to order early. There is some scope for certification bodies to give derogations where organically grown varieties are available, but not ideally suited to the end use or growing situation, however it is possible that growers may have to grow less than ideal cultivars to retain certification. Home-saved seed is an option but there are issues of seed borne diseases and weed seed spread to consider and these are discussed elsewhere in this publication.

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