



Canolfan Organig Cymru
Organic Centre Wales



Towards Welsh grown malting barley: The potential of 'Pipkin'

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The Better Organic Business Links (BOBL) project, run by Organic Centre Wales, is a four year project designed to support the primary producer in Wales and grow the market for Welsh organic produce in a sustainable way.

The aim is to develop markets for organic produce whilst driving innovation and promoting sustainable behaviours at all levels within the supply chain, to increase consumer demand and thence markets for organic produce, especially in the home market, and to ensure that the primary producers are aware of market demands. The project provides valuable market information to primary producers and the organic sector in general.

Delivery of the project is divided into five main areas of work:

- 1. Fostering innovation and improving supply chain linkages*
- 2. Consumer information and image development of organic food and farming in Wales*
- 3. Market development*
- 4. Providing market intelligence to improve the industry's level of understanding of market trends and means of influencing consumer behaviour*
- 5. Addressing key structural problems within the sector.*

In all elements of the work, the team are focused on building capacity within the organic sector, to ensure that the project leaves a legacy of processors and primary producers with improved business and environmental skills, able to respond to changing market conditions, consumer demands and climate change.

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Executive summary

The Better Organic Business Links Project helps to identify new opportunities for organic producers in Wales. One of these opportunities is the reinvigoration of Wales' grain economy. This report was prepared in response to interest from Welsh brewers and distillers in using a particular winter malting barley variety, 'Pipkin'. The variety was bred in the 1980's under Welsh conditions at IBERS near Aberystwyth. It was quite widely grown until the mid-1990's, when other varieties superseded it. It was used on a trial basis by Penlon Cottage Brewery to make a 'Cardi best bitter' in the recent past (2009).

This study summarises the available information on Pipkin in terms of its agronomic and malting characteristics. It is intended to help growers, brewers and distillers to make an informed decision on whether or not grow and use the variety.

In terms of agronomy the variety has some important strengths including: Good malting potential; an ability to grow relatively well on less fertile, heavier soils; and good resistance to net blotch. Weaknesses on the other hand are: Lower yield potential; weak straw making it susceptible to lodging; and susceptibility to some important diseases including mildew, scald (*Rhynchosporium*) and barley mild mosaic virus. With respect to organic and low input systems, disease susceptibility is clearly a concern. However, the low/ no N inputs may mean that lodging is less likely to be a problem. Also, the more modern varieties require high N inputs to realise their yield potential, so under organic systems, the differential between them and Pipkin is likely to be smaller.

In terms of malting, figures for Nitrogen content were not available, but the experience with Penlon suggests that the specifications can be met. However, Pipkin tends to produce a higher proportion of smaller grains than other varieties currently in use, which can lead to uneven germination during the malting process.

In summary, it is possible to grow Pipkin under Welsh conditions and use it successfully for brewing and distilling. It could work well in organic/ low input systems but growers must be aware of the risks posed by its low resistance to a number of key diseases, and the potential for price penalties associated with variable grain size.

1. Background

A large part of the Better Organic Business Links Project centres on identifying new opportunities for organic producers in Wales. One of these opportunities is the reinvigoration of Wales' grain economy. At present practically all grain from Wales is destined for the feed market. This is limiting for a number of reasons including: Feed grains attract a lower price compared to milling or malting varieties; there is no premium for quality; there is little or no opportunity to add value; and the Welsh branding on baked goods, beers and spirits is weakened because the grain is not produced here.

The Welsh Grain Forum was formed in 2013, and came about through a desire of many businesses and organisations to work together towards a thriving local Welsh grain economy. It includes farmers, millers, bakers, maltsters, brewers, thatchers and distillers. This report is the result of interest from the distillers and brewers in the group in a particular malting barley variety, 'Pipkin', which was bred in Wales. This report summarises all the available information on this variety. Its purpose to enable both processors and growers to make an informed assessment of its potential to contribute to more locally, i.e. Welsh, produced products.

2. Organic malting barley in the UK¹

The UK as a whole can grow organic malting barley successfully, and 75% of organic barley grown for malting could meet malting standards. Spring varieties are preferred to winter varieties because the crop needs to get off to a vigorous start, which in turn means planting in to a warmish soil (8⁰c and rising), usually from mid-April onwards. Barley is sensitive to low soil pH and a soil pH of 6.0 to 6.5 is necessary for optimum yields. Below 5.5 crops will suffer serious yield reduction. Agronomic characteristics such as long straw and competitive growth are essential for organic production over and above the crop being a known "malting variety".

3. A brief history of Pipkin

Pipkin, a winter malting barley variety, was bred in Wales at the Welsh Plant Breeding Station (WPBS) now IBERS, Aberystwyth. It was developed by crossing winter barley varieties Sergeant and Maris Otter using double haploid technology.

The National Institute for Agricultural Botany (NIAB) subjects varieties to extensive trials in the main cereal growing areas, and then decides whether to include in the 'Recommended list'. Varieties are only added to this list if their performance is as good as or better than that of the best comparable variety already listed.

When Pipkin was listed by NIAB its yield was approximately 25% higher and brewing extracts 2-3% lower than Maris Otter, a barley variety introduced in 1966 which delivered consistently low nitrogen and high malt quality for the cask conditioned ale market. Maris Otter, despite no longer being on the NIAB recommended list, continues to be available to meet the demand of craft brewers through a merchant-led integrated

¹ Based on comments from: *Stephen Briggs, Abacus Organics; Tom Wood; Robin Appel; Roger Wyatt, Organic Seed Producers*

supply chain which offers farmers a premium price to compensate for the lower yield and risks associated with growing malting barley. Although a quality barley for malting, Maris Otter is unsuitable for growing organically. (Personal communication; Roger Wyatt, Organic Seed Producers)

During kilning Pipkin produces a high level of a precursor for the formation of dimethyl sulphide, a characteristic which influences the aroma and flavour of lager type beer. Kilning at higher temperatures can reduce the production of the precursor.

In 1984 Pipkin was listed as provisionally recommended on the NIAB Recommended List of Cereals. Full recommendation, as a “special use” malting variety, followed in 1986 and Pipkin remained in this category for 13 years until 1999. In 1998 it received the Institute of Brewers Thompson Perpetual Challenge Trophy for the most successful and established new variety. In 1999 Pipkin became outclassed by newer varieties and was no longer listed by NIAB. The NIAB recommended lists have been superseded by the HGCA Recommended lists.

In 2005- 2006 Pipkin was regenerated by propagating farm scale quantities of seed from stored genetic stocks. Test production of around 10 tons was grown during 2007-2008 on an Aberystwyth University farm near Aberaeron, Ceredigion and was used by Penlon Cottage Brewery to make a best bitter ‘Cardi-bay’.

The first year’s crop made a good quality product, but there were problems in the second, thought to be linked to an excess of nitrogen in the grain. Although definitive record field records were not available, an error in nitrogen fertiliser application in the second year was the suspected cause and therefore not attributable to varietal characteristics per se.

4. Strengths and weaknesses of Pipkin

Strengths	Weaknesses
Good malting potential	Small grain size
Less sensitive to low fertility sites than other malting barley varieties	Low/ Limited yield potential compared to feed barley
Good resistance to net blotch	Weak straw- susceptible to lodging (less of a problem at low rates of N fertiliser)
Can produce quality malting samples on heavy land	Highly susceptible to mildew and <i>rhynchosporium</i>
Preferred sowing dates are before end of October, but can be as late as end of February.	Susceptible to barley mild mosaic virus; less susceptible to barley yellow mosaic virus

*1996 UK yield as % control 5 year mean 6.4 tonnes /ha, 2014/5 all listed winter barley average yield without fungicide 82%; UK yield average 8.9 tonnes/ha

Adapted from NIAB Recommended Cereal Lists 1986-1999

For the purposes of comparison, the key characteristics of current malting barley varieties are summarised below:

Westminster	Optic	Propino
First listed 2005: tall, competitive, good yield of straw for mixed organic farms, good disease resistance characteristics. No Institute of Brewing and Distilling (IBD) approval	First listed 1995:susceptible to scald (<i>Rhynchosporium</i>). No longer approved by IBD for brewing , approved by IBD for distilling	First listed 2010: new variety, increasing interest, lower straw yield, slightly more susceptible to yellow and brown rust, higher untreated grain yield. Full IBD approval for brewing

5. Agronomic data

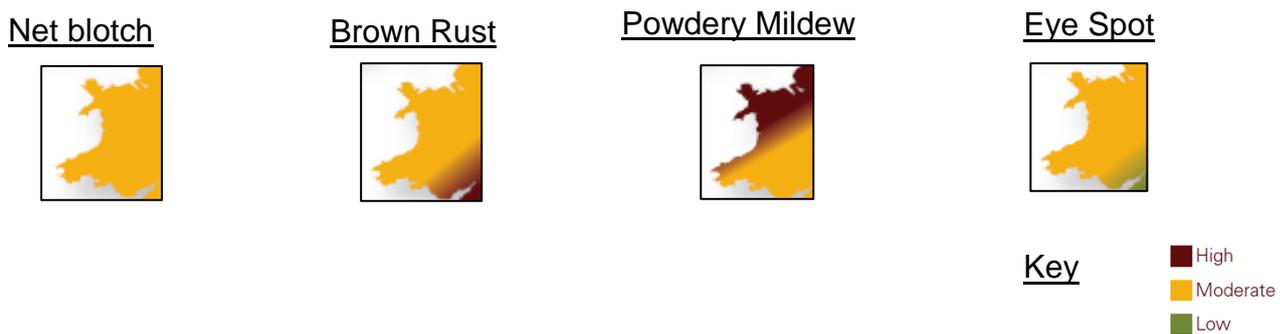
Detailed information on the agronomic characteristics of Pipkin can be found in Table 1 and comparison with more recent varieties in Table 2.

In conventional systems, the yield potential of Pipkin is low compared to its more recent counterparts such as Westminster and Optic (6.14 t/ha for Pipkin compared to 7.7. and 9.7 for Optic and Westminster respectively). However, it is likely that the high yields of the latter depend on high inputs, in particular N. When N fertiliser was not applied the average yield of Pipkin over 3 years was 4.24 t/ ha, which is very similar organic feed winter barley yields (4.25 t/ha according to the 2014 Organic Farm Management Handbook).

Perhaps of greater concern is the breakdown of resistance to key diseases including mildew and scald between 1986 and 1996, although resistance to net blotch remained high throughout that period. The risk of mildew is particularly high in North Wales (Figure 1). However there are cultural controls, summarised in Figure 2 that can help to manage these disease problems.

In summary, while the lower yields of Pipkin compared to current varieties may not be such a big issue for low input and organic producers but the breakdown of disease resistance should be a major concern of growers, particularly in the higher risk areas shown in Figure 1.

Figure 1: Risk of some key barley diseases in Wales



Source: HGCA Barley disease management guide

Figure 2: Management Factors Influencing Disease Susceptibility in Barley

	Rhynchosporium	Ramularia	Net blotch	Rusts	Mildew	Eyespot
Early-sown	↑↑	↑↑	↑↑			↑↑
High N/ dense crop	↑	↓↓		↑↑	↑↑	
Min-till, if following barley	↑↑		↑↑	↑	↑	↑↑

Key

- ↑↑ Increased risk
- ↑ Small increase in risk
- ↓↓ Decreased risk

Source HGCA Barley disease management guide

Table 1: Pipkin: Information collated from the Recommended Varieties of Cereals, NIAB

	1986	1987	1988	1989	1990	1991	1994	1995	1996
Yield and Agronomic Characteristics									
Untreated control yield* (4 yr mean t/ha)	5.79	5.92	6.19	5.78	5.87	5.93	6.18	6.04	6.14 (5yr mean)
With fungicide treatment (Yield as % untreated control; 4 year mean)	105	116	110	113	117	119	115	117	117
No fungicide treatment (Yield as % untreated control; 4 year mean)	95 (5yr mean)	105	100	99	98	95	88	87	88
Standing Power	4	3	3	3	3	4	4	4	4
Shortness of Straw	6	6	6	6	7	7	7	7	7
Earliness of ripening	6	6	6	6	6	6	6	5	5
Winter Hardiness	6	6	6	6	6	6	5	Insufficient data	Insufficient data
Resistance to Disease									
Mildew	9	9	9	(4)	2	2	2	2	2
Yellow Rust	6	6	5	5	6	6	6	7	7
Brown Rust	4	4	3	4	4	5	5	6	6
Rhynchosporium	7	8	7	7	7	7	7	3	3
Net blotch	8	8	8	8	9	9	9	9	9
Eyespot	-	-	-	-	-	2	4	-	-
Barley Yellow Dwarf virus	-	-	-	3	-	-	-	-	-
Loose smut	-	-	3	3	2	2	-	-	-
Grain Quality									
Malting Grade	(9)	9	9	9	9	9	9	9	9
Specific weight (kg/hl from 1987)	8	67.2	68.7	69.1	69.4	71.9	71.1	71.2	70.4
1000 grain weight	4	4	5	4	4	4	4	4	4
Recommended List									
	Provisional	Provisional	Yes	Yes	Yes	Yes	Yes	Yes	Yes

1992/3 information not found. *Control for yield comparison is the mean yield of 4 or 5 selected Winter Barley varieties listed by NIAB that year. A high figures indicates that the variety shows the character to a high degree, () limited data

Table 2: A comparison of Pipkin (NIAB 1996) with Westminster and Optic (HGCA Recommended list 2015)

	Pipkin (1996)*	Westminster (2015)	Optic (2015)
Yield and Agronomic Characteristics			
Untreated control yield(4 yr mean) t /ha	6.14	84	77
	5yr mean		
Treated control yield	N/A	7.1 t/ha UK, 7.5 t /ha West	
Grain Yield: with fungicide treatment % of treated control	117	93,UK; 94, West	93,UK; 92, West
Untreated grain yield % of treated control	86	84	77
Standing Power	4	7 (resistance to lodging) 7 (resistance to brackling)	7 (resistance to lodging) 5 (resistance to brackling)
Shortness of Straw	7	82 (Straw height cm)	75(Straw height cm)
Earliness of ripening	5	+1	Control variety
Winter Hardiness	Insufficient data	-	-
Resistance to Disease			
Mildew	2	8	5
Yellow Rust	7	7	7
Brown Rust	6	6	7
Rhynchosporium	3	7	3
Ramularia	-	7	5
Net blotch	9	-	-
Grain Quality			
Malting Grade	9	Not available	Not available
Specific weight kg/hl	70.6	70	70.1
First listed	1986	1995	2005
Current Status	Outclassed , very small amount of seed available	Listed but not approved by IBD	Recommended for North region no longer approved for brewing by IBD approved for distilling IBD

A high figures indicates that the variety shows the character to a high degree; * different control to Westminster and Optic

6. Malting characteristics²

UK maltsters buy about 1.9 million tonnes of malting barley every year. Around 460,000 tonnes of winter and 1,450,000 tonnes of spring malting barley are used by the UK malting industry to produce 1.55 million tonnes of malt.

In terms of quality, germination is the most critical factor for maltsters, with a minimum 98% viability being the standard, followed by nitrogen content. The distilling industry uses malt produced from around 1,000,000 tonnes of spring malting barley each year, and require nitrogen levels to be below 1.65%. Compounds called 'Glycosidic nitriles' (GN) are problematic for distillers, which some barley varieties produce during the malting process and consequently they only use non-producing or low GN varieties. Only one, Concerto, is approved for distilling.

Brewers can use malts with a wider nitrogen range generally between 1.65% - 1.85%. There are currently four winter and three spring malting barley varieties fully approved for brewing.

Grain size and uniformity are important to maltsters. They are looking for plump, even sized corns which absorb water at an even rate and amount, which in turn helps to ensure that germination takes place all at the same time and with equal vigour. Small or under-sized grains are screened out prior to the malting process (analogous to grade-outs in fruit and vegetable production). In the context of this process, grains under 2.25mm are known as 'screenings' and the 'retention' is the proportion grain that remains after the process and goes on to be malted.

Moisture content is also critical is higher than that required for milling or feed grain. It needs to be less than 19% and levels of 16 - 17% are typical.

Table 3 summarises some of the malting characteristics of Pipkin and some more recent varieties. Figures for nitrogen are not available for Pipkin, but the experience of Penlon Cottage Brewery indicates that a) Pipkin barley can produce a quality beer and b) that the nitrogen content is influenced as much by management as it is by varietal characteristics. With respect to the latter, organic systems, which do not use N fertilisers, are less likely to produce grain with excess Nitrogen. Data on moisture content is also unavailable for Pipkin, but again management practices such as correct timing of harvest are likely to be more important than the intrinsic characteristics of the variety.

The relative lack of uniformity of the grain compared to other varieties is a potential drawback. While this does not prevent the variety from being used, high levels of screenings and low levels of retention will inevitably mean price penalties for the grower.

² Based in information on from The Maltsters Association of Great Britain, <http://www.ukmalt.com>

Table 3: Malting characteristics of Pipkin and some key malting barley varieties

	Nitrogen %	Screenings <2.25mm %	Retention >2.5mm %	Moisture %
Pipkin* 1991-5	Not available	6.3	76.8	Not available
Westminster 1991-5	Not available	3.5	98.5	Not available
Optic 1991-5 (2014)	1.5 (1.4)	2.6	97.4	16.9
Propino 2014	1.49	2.1	97.9	16.4
Others 2014	1.65	2.7	92.5	16.3
Spr Average 2014	1.47	1.7	96.1	16.5
Target *	Cask: Up to 1.55 Other brewers 1.65-1.75 Distilling up to 1.65		94% (England & Wales)	Less than 19% at harvest

*Sources: Maltsters Association of Great Britain; NIAB Recommended list 1996

7. Potential for growing Pipkin in Wales

In terms of agronomy the variety has some important strengths including an ability to grow relatively on heavier soils which are characteristic in many parts of Wales compared to, say, East Anglia. In addition some of the issues highlighted in the context of higher input systems such as lower yield potential and lodging are less likely to be a problem in the lower N conditions characteristic of organic and low input systems. Susceptibility to important diseases such as mildew, scald (*Rhynchosporium*) and barley mild mosaic virus must be an area of concern, particularly in organic systems where fungicidal treatments are not an option.

8. Conclusions

It is possible to grow Pipkin under Welsh conditions and use it successfully for brewing and distilling. It could work well in organic/ low input systems. However, growers must be aware of the risks posed by its low resistance to a number of diseases, and the potential for price penalties associated with variable grain size.