

Oat genetic diversity and history

Catherine Howarth



What are oats?

Oats are a natural allopolyploid which evolved through cycles of interspecific hybridisation and polyploidisation combining 3 progenitor diploid genomes

Diploid
A
 $2n = 14$



Tetraploid
DC
 $2n = 28$



Hexaploid
ADC
 $2n = 42$



Avena strigosa
 $2n = 14$
Small
oat

DOMESTICATION

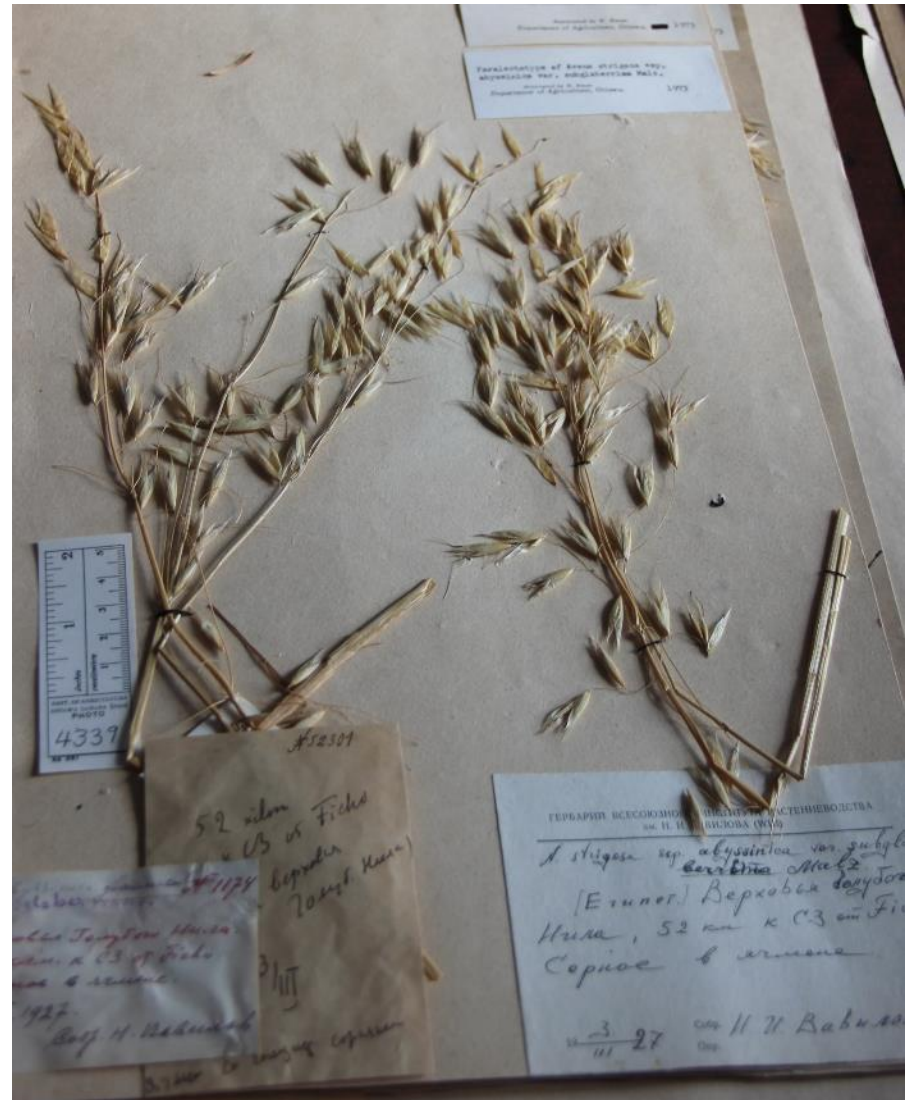


Avena sativa
 $2n = 42$
White
oat

Ceirch Llwyd (Welsh), Corc beag (Gaelic)
Small, bristle, sand, grey, black or oat



Specimens in Vavilov Institute, St Petersburg



Talybont show schedule 2019

GWREIDDIAU A GRONYNNAU ROOTS AND GRAINS

2 Gais yn unig yn mhob Dosbarth/2 Entries only in Each Class

Beirniad/Judge: Mr ROGER CLOTHIER, Glannant, Llanilar, Aberystwyth

Gwobru/Prizes: 1af/1st £5, 2il/2nd £3, 3ydd/3rd £2

Tâl Cystaldu/Entry Fee 75c

- 1 2 goes o Fresych Deiliog (Mil o bennau)/2 stems Kale (Thousand head)
- 2 2 goes o Fresych Deiliog (Coes denau)/2 stems Kale (Narrow stem)
- 3 2 Fresychen/2 Cow Cabbage
- 4 6 planhigyn rêp/6 Rape plants
- 5 3 Erfinen/3 Turnips
- 6 Sampl Orau o Wenith – 30 tywysen/Best Sample of Wheat – 30 ears
- 7 Sampl Orau o Farlys – 30 tywysen/Best Sample of Barley – 30 ears
- 8 Sampl Orau o Geirch – 30 tywysen/Best Sample of Oats – 30 ears
- 9 Sampl Orau o Geirch – Ceirch Llwyd – 30 tywysen
Best Sample of Oats – Ceirch Llwyd – 30 ears
- 10 Belen o Wair Dôl/Bale Meadow Hay
- 11 Belen o Wair Hadau/Bale Seed Hay
- 12 Tywarchen Orau o Borfa Sefydlog/Best Sod of Permanent Pasture



PRIFYSGOL

ABERYSTWYTH
UNIVERSITY

IBERS

Athrofa y Gwyddorau Biolegol, Amgylcheddol a Gwledig
Institute of Biological, Environmental and Rural Sciences

naked oat



husked oat



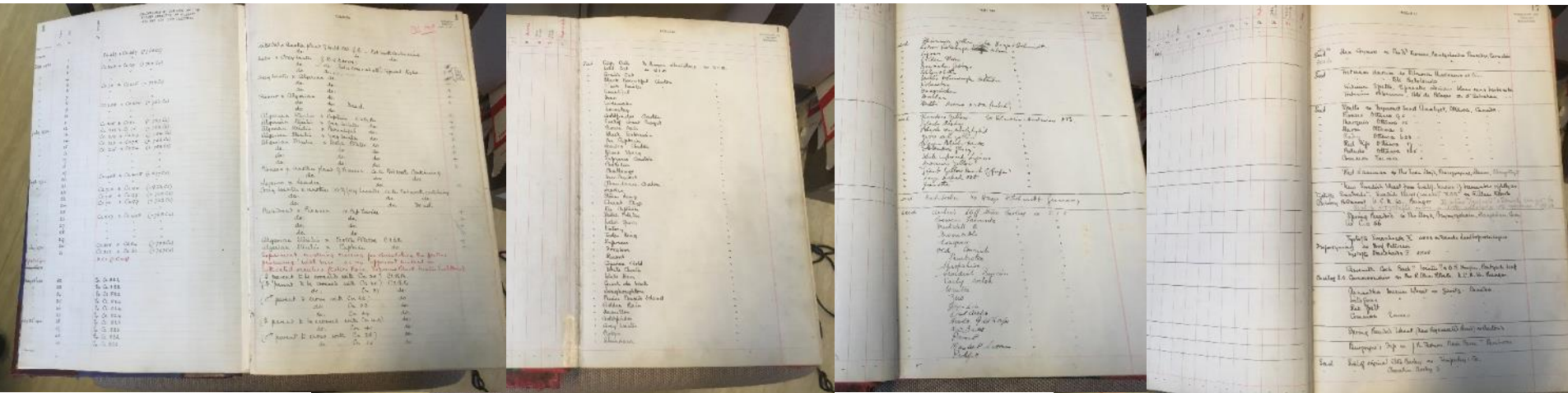
Naked diploid oat



Pilcorn, Piley, Pillez

Welsh Plant Breeding Station started in 1919 as part of Aberystwyth University

Crop range included wheat, barley, oats (both diploid and hexaploid), forage grasses, beans, peas, brassicas, forage legumes eg white clover, red clover



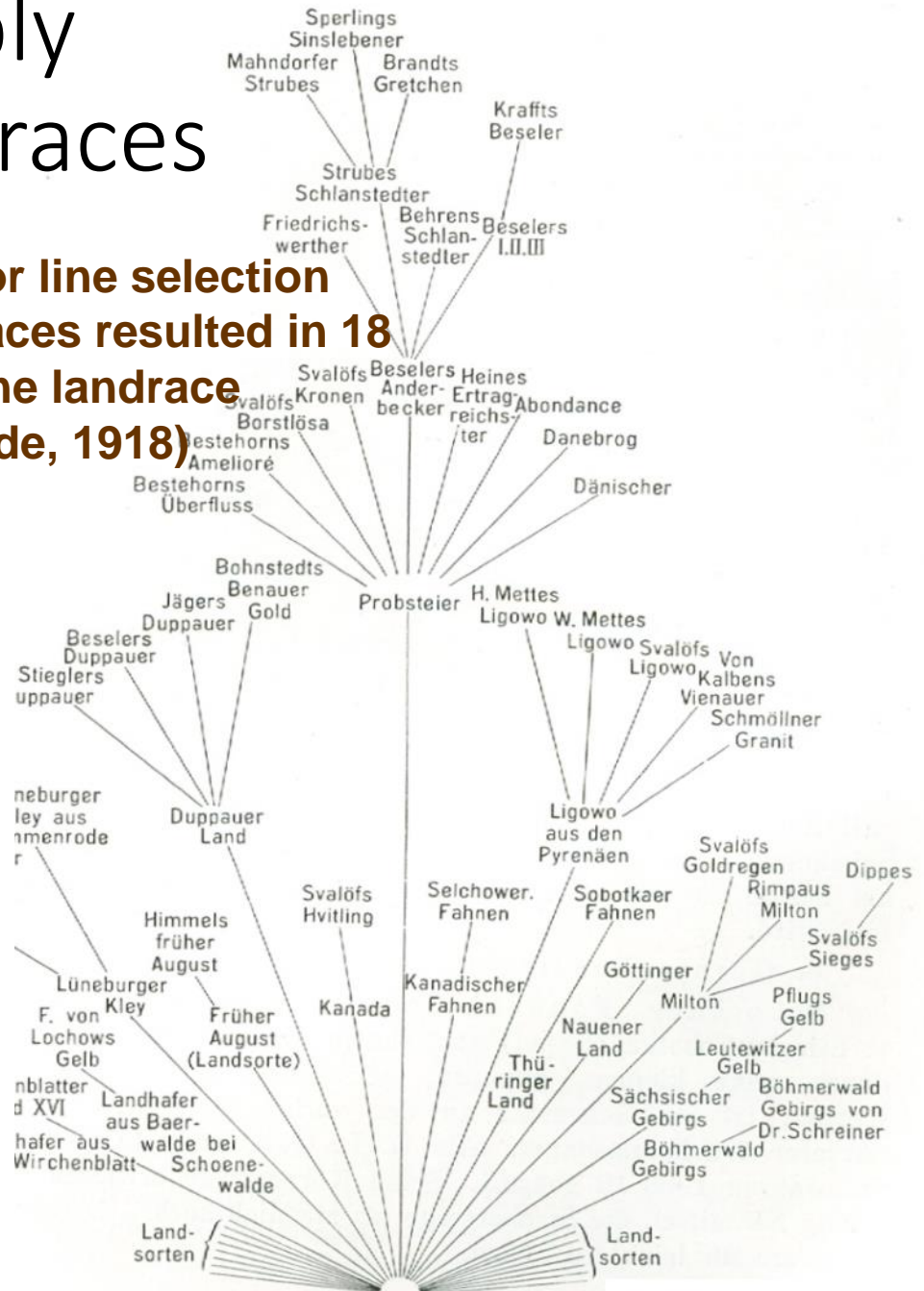
Current breeding mandate includes oats, beans, peas, forage and amenity grasses, forage legumes and Miscanthus

Early breeding simply selection from landraces

Mass selection or line selection within oat landraces resulted in 18 cultivars from one landrace (Probsteier) (Zade, 1918)



Hen Gardie



Before 1919, Gartons bred many varieties of oats



A FURTHER TRIUMPH IN THE ART OF PLANT BREEDING.

GARTONS Distinct New Breed of White Oat
"THE CAPTAIN"

Pedigree:—WAVERLEY SCOTCH POTATO THE YIELDER

"THE CAPTAIN,"

DESCRIPTION:—Very early; ripens as early as "The Yielder"; ear fairly long, compact and Tartarian; grain white, long and plump, with thin husk; straw very short and exceptionally strong.

QUALIFICATIONS:—Earliness, Strength of Straw, Quality of Grain, Extraordinary Yielding Powers.

STOCK VERY LIMITED: EARLY ORDERS ESSENTIAL.
Introduced for the first time. Obtainable only from the Breeders.

Gartons Ld. THE SCIENTIFIC SEED EXPERTS. **Warrington.**

Advert in the Cambrian News 1919

VARIETIES OF OATS AND WHEAT.

EXPERIMENTS IN NORTH WALES.

The results of a series of experiments with numerous varieties of oats and wheat conducted by Professor R. G. White and his staff at the farm in connection with the University College of North Wales, are embodied in a report recently published. Several of the varieties supplied by Messrs Gartons are favourably commented upon in the report. Their "Leader" oats was one of the first varieties to ripen in 1914 and 1915, a point of considerable importance, particularly in many of the late districts in North Wales. The same firm's "Record" oats did very well during the last three years at the College farm and is strongly recommended for land in high condition, particularly in the wet climate of the western districts of North Wales. "Supreme," a new variety placed on the market for the first time in 1915 by Messrs Gartons, gave a good yield of grain and was one of the first varieties to ripen.

North Wales Examiner 1916



Oat breeding at IBERS



- Winter and spring oats
- Husked and naked oats



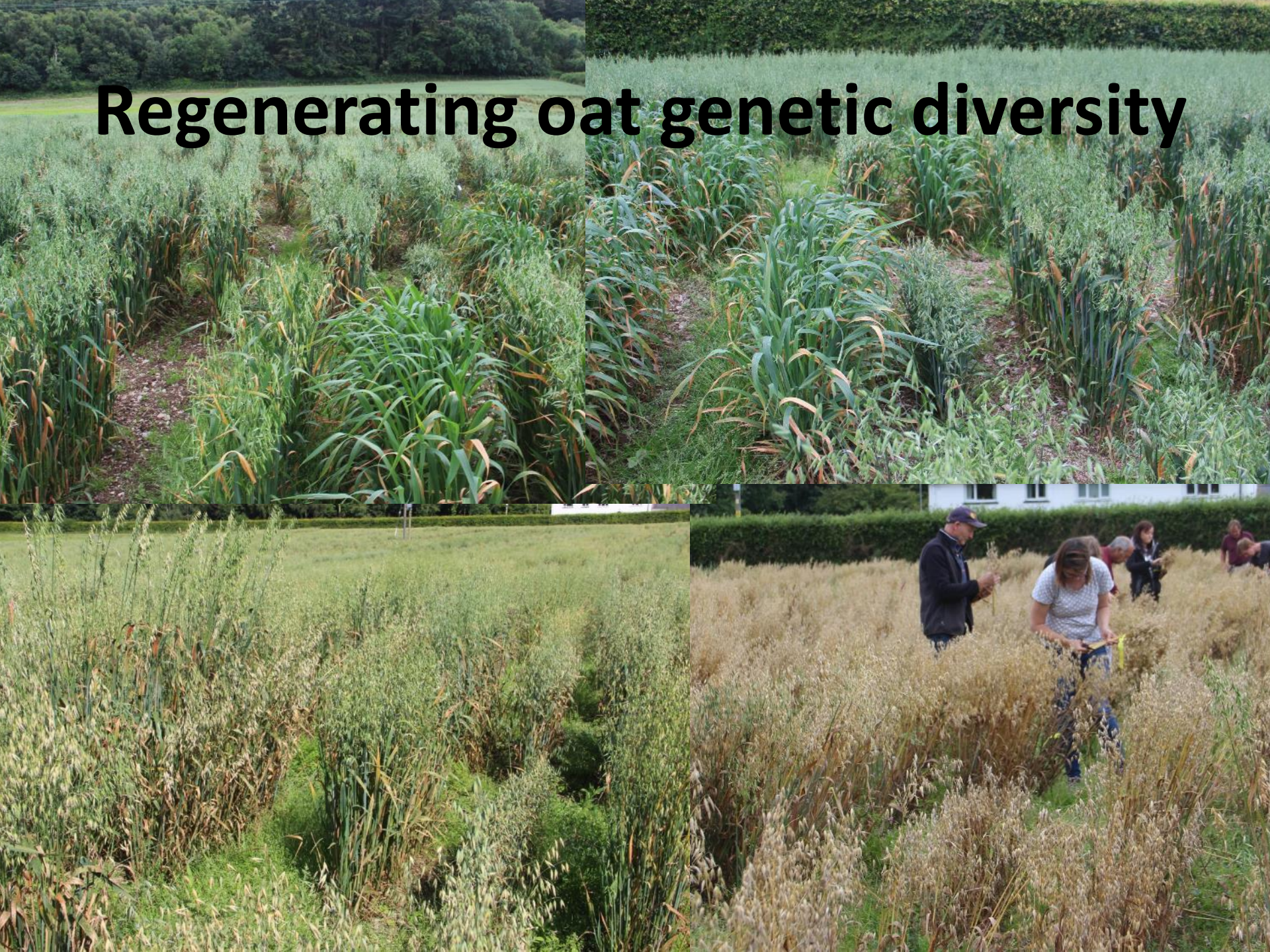
65% of oats used in UK bred in Aberystwyth
Varieties marketed through Senova Ltd.



Breeding for decreased plant height,
enhanced yield, disease resistance and
milling quality



Regenerating oat genetic diversity













Bountiful



Emrys



Giant Yellow



Goldfinder



Compact



Argentina



Manod



**Radnorshire
Sprig**



Marvellous



Record



Victory



Potato



S80



Sir Douglas Haig



Hen Gardie



Red Rustproof



Firth



Glamis



Dyfed



Lennon

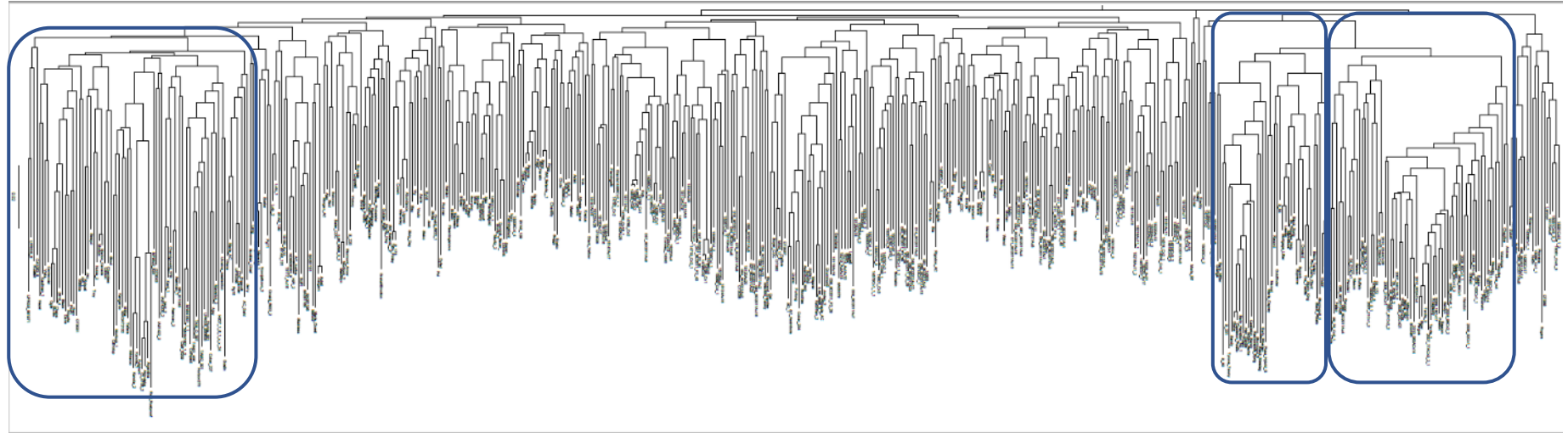


The Yielder



Examples of grain types grown in Aberystwyth 2019

Molecular characterisation of oat genetic diversity



Red Oats

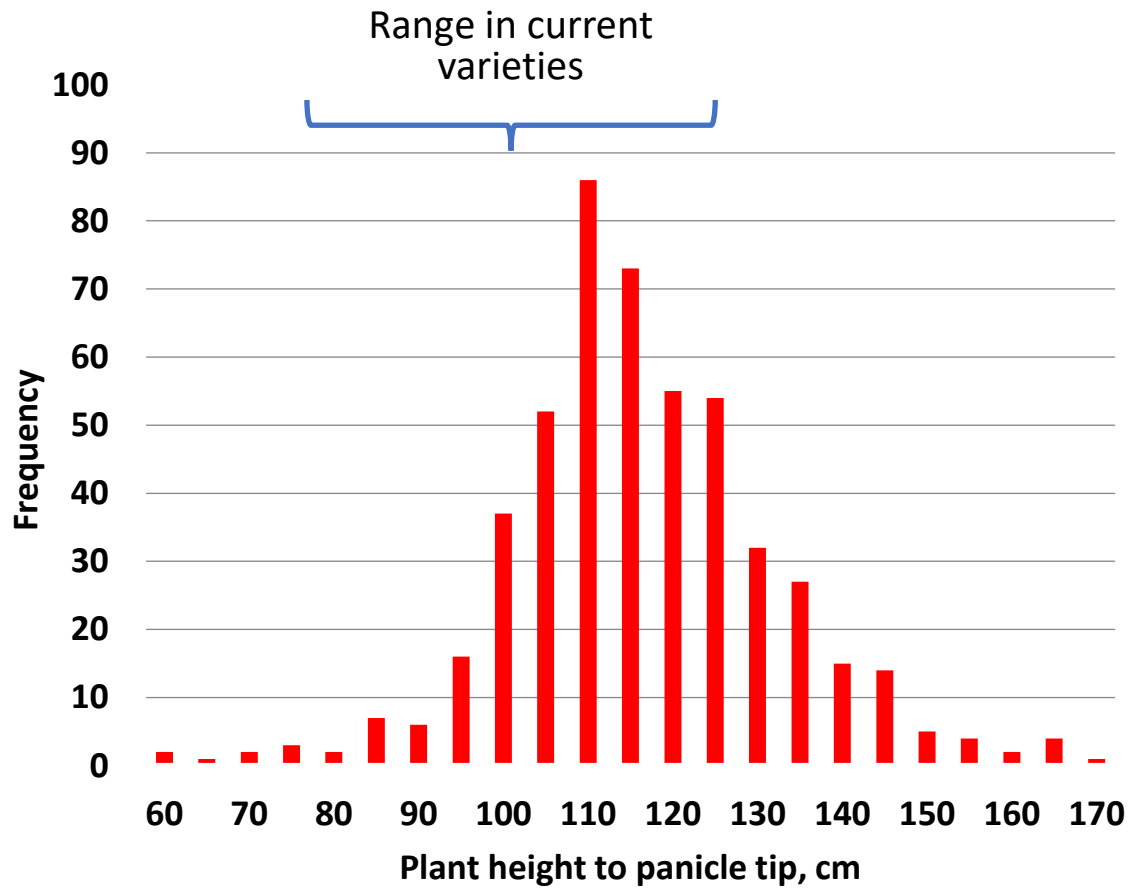
**North American
Spring Oats**

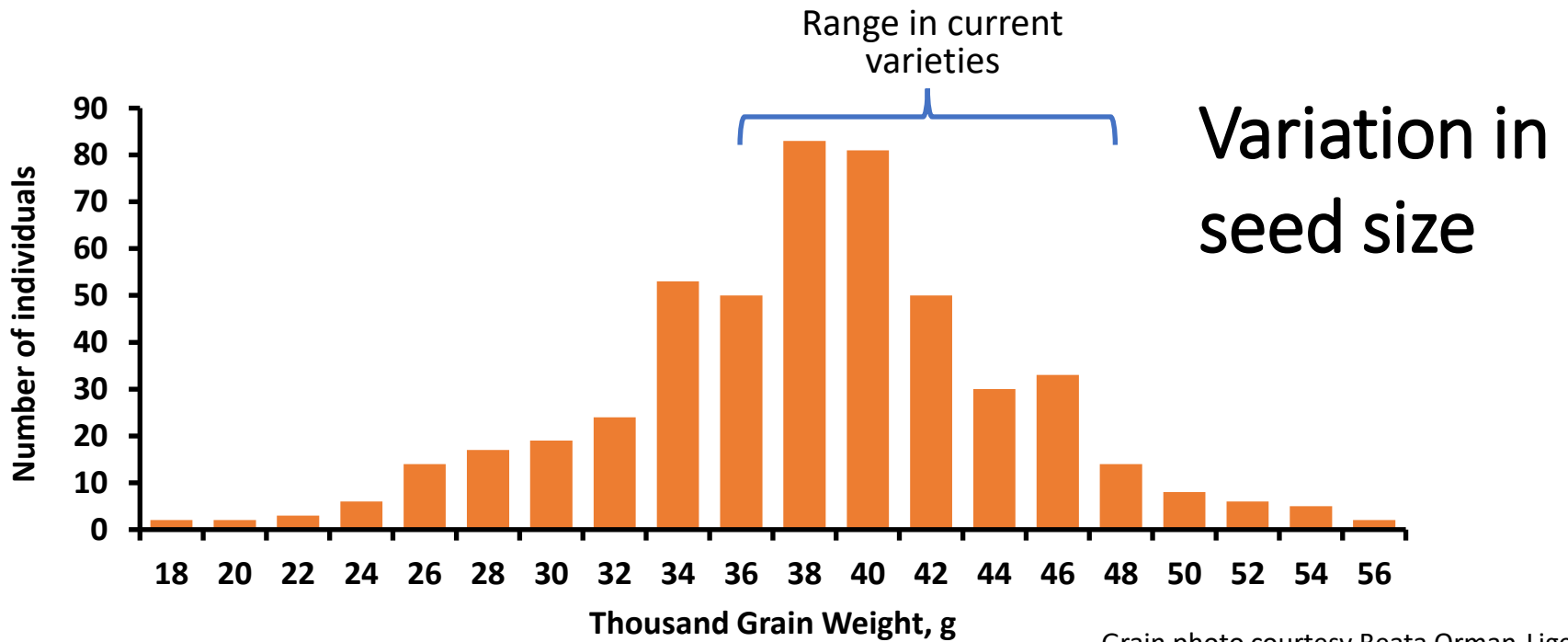
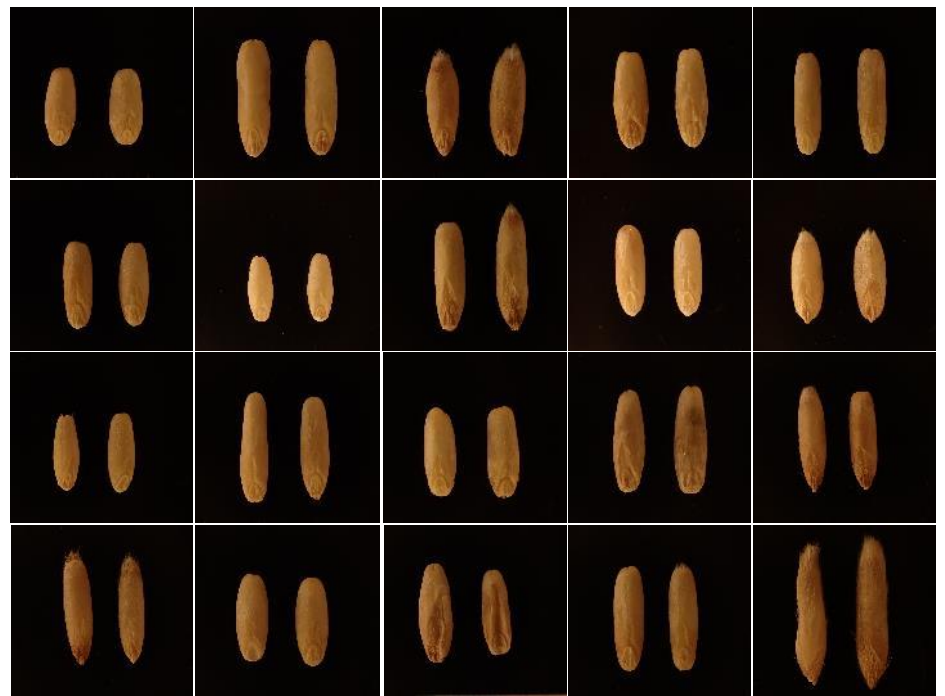
**European Spring
Oats**

**Heritage
lines**

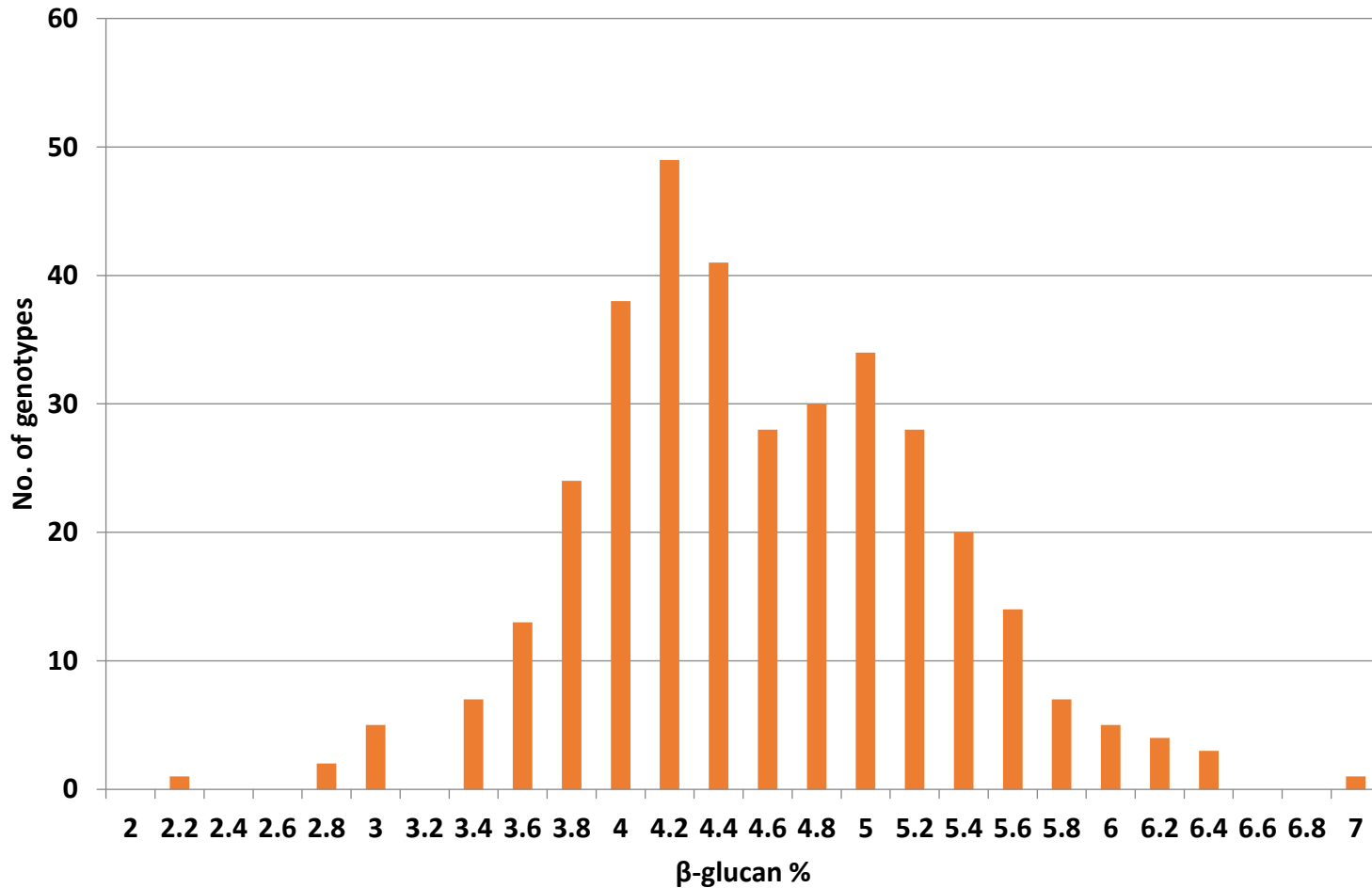
**Winter
Oats**

Variation in plant height

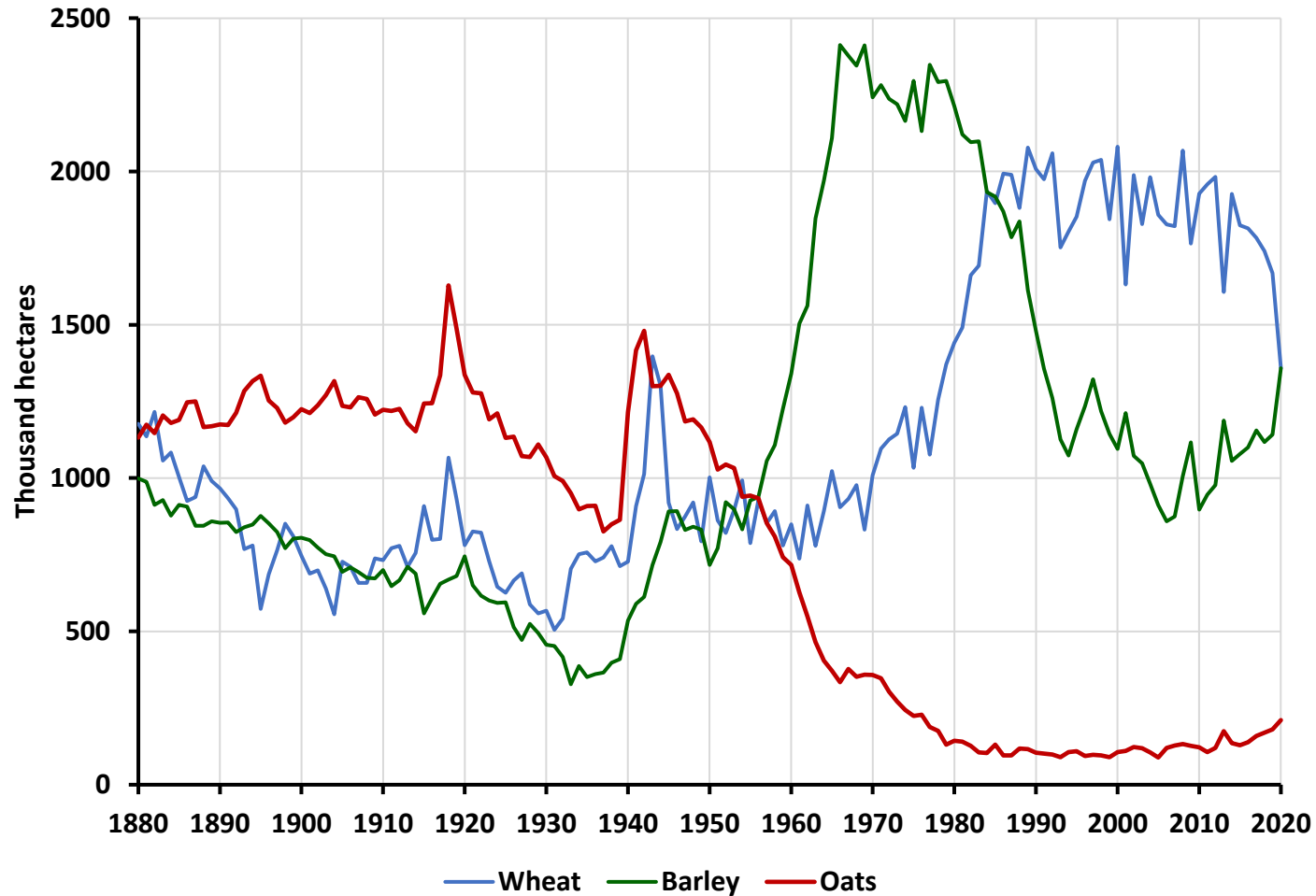




Range in β -glucan content



Cereal production in Great Britain



Journal of the Cardiganshire Antiquarian Society

1971: Rural Industries in Cardiganshire

CORN MILLING

One of the most widespread of all the rural industries of Cardiganshire was that of corn milling and a water-driven mill was to be found on the bank of most streams. In the nineteen twenties, the following were in operation in the county* :

Clarach (Ruel)	Gilfachreda (Wern)
Llechrud (Penrallt)	Llandysul (Dolifor)
Llangunilo (Geras)	Llandysul (Pontweli—2 mills)
Troed-yr-aur (Cwmhyar)	Llandysul (Cletwr)
Ciliau Aeron (Ty-gwyn)	Llandre (Cynnull Mawr)
Ciliau Aeron (Rhiwbren)	Llanddewi Brefi (Gogoran)
Llangeitho (Felin Fawr)	Llanddewi Brefi (Gorwydd)
Llangeitho (Felin Fach)	Tre'rddol
Llangeitho (Rhydypanyd)	Llwyndafydd
Brongwyn (Trewen)	Ferwig (Felin bedr)
Aberarth	Nantcwnlle (Felin coed)
Penbryn (Llanborth)	Nantcwnlle (Felin fach)
Betws Leucu (Felin Fawr)	Aberacron
Llanrhystud (Felin Fawr)	Tal-y-bont
Llanrhystud (Rhiwbwys)	Llangwryfyon (Pontfaen)
Llanrhystud (Felin cwm)	Aberporth
Llanbadarn (Tredowlgoed)	Rhydowen
Llanbadarn (Coedgwan)	Llangrannog (Felin Uchaf)
Llanio	Llangrannog (Felin Isaf)
Llanddeiniol (Garrog)	Blaenpennal
Lampeter	Llanfair Clydogau
Ponhirwaun	Cardigan (Felin Ganol)
Cribyn (Hafod wen)	Cardigan (Felin newydd)
Llanarth (Llyfannog)	Talgarreg
Lledrod (Ty'n y porth)	Llandyfriog (Cwrrws)
Llandyalllogogo (Synod)	Tal-y-bont (Elerch)
Llanllwchaearn (Nant y pelau)	Cwm-tydu (Felin Huv)
Llanllwchaearn (Pontbren)	Penparc (Felin fach)
Llannerch aeron (Pandy)	Pontrhyllendigaid
Rhyd y felin (New Mill)	Felinfach
Llanfair Orllwyn	Capel Bangor
Aberystwyth (Mill Street)	Blaenannerch (Blaenpistyll)
Aberystwyth (Morfa Mill)	Maes-llyn
Rhydlewis (Brithdir)	Swyddfynnon
Rhydlewis (Felin cwm)	Brongest
Mydroilyn	

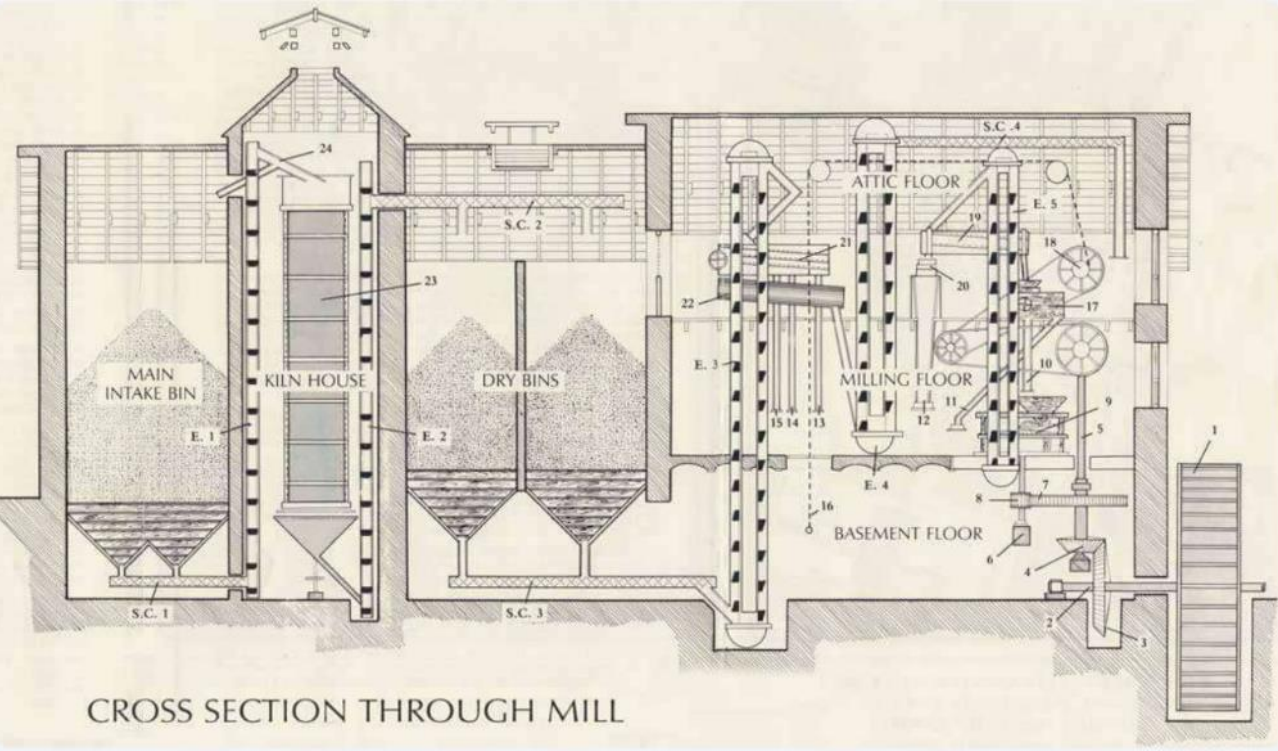
On the ground floor is found the shutes and troughs for the milled flour and husks, together with a winnower (*mashin nithio*) mainly used for winnowing **oats**. In this, **oats** were sieved to separate the husks from the flour. The room adjoining the mill is the kiln where **oats** were gently heated for some hours before milling. A fire was lit in the grate underneath a metal-bottomed, perforated grain container, the walls of the device being of stone. The **oats** were placed on the metal, a fire of culm lit underneath and the **oats** gently heated, the grain being gently mixed every twenty minutes or so with a long-handled wooden rake known as a *corloc*. Usually **oats** were roasted for three hours, and after cooling for twelve hours or more the grain was milled. It was then winnowed and the oat kernels were again milled. Occasionally the husks, too, were milled. Oatmeal was, of course, a staple diet in south Cardiganshire, essential for making such foods as *sucan*, *bwdram*, *cawl dwr*, and *cawl llaeth* as well as *bara ceirch*.

KILNS FOR DRYING OATS.

A large part of the grain crops raised this season in North Wales (says a correspondent in the *Manchester Guardian*) consists of **oats**, especially in the hilly districts, where the extremely wet and stormy weather has made harvest operations practically impossible since the crop ripened. The situation has stirred the memories of the old men in the rural areas, who are recollecting what they heard their fathers say about the days when, as now, the growing of cereals was an important feature of the husbandman's vocation. "Why," asked one elderly Welsh farmer, with whom I discussed the subject, "should we depend to so great an extent upon **oats** and oatmeal from Scotland and America? Why should we not use what we produce in our own land? We formerly did it; it is a shame we are not doing it now." Here and there, he explained, in most parts of North Wales, we may see the ruins of the kilns in which at one time **oats** were dried, in order that they might be ground into meal, or crushed, for human or cattle food. If the kilns were available now the **oats** from the fields might be brought in only partially dried and the drying process completed in the kilns, instead of leaving the unthreshed grain to ripen in the stacks and make it fit for grinding—a long and uncertain process.

Many buildings in which the kilns were situated have been converted to other uses, and some actually exist to-day, one being at what is known as Down Mill, in the Llanddufne Valley, which has for some time been untenanted. Could not a start be made with this mill, the farmer asked, and then, if it succeeds, it could be made an object-lesson for other places? Near it is plenty of wood—the branches of the trees recently carried away from the hill-sides—which could be used for heating the kiln. Splendid crops of **oats** are available in the surrounding country, and at present are deteriorating from exposure to the wet weather.

Another correspondent states that the kilns have not quite disappeared or entirely ceased to be used in North Wales. One is still worked at Llangernyw, between Abergel and Llarrwet, and another is in use at Glasfryn, near Cerrigydruidion, and the prepared **oats** and meal from them are sold in the rural parts of North Wales for porridge making.



Aberfeldy water mill

North Wales Chronicle
1919



Tithe map c. 1837

Blue arrows indicate arable fields in an upland area near Aberystwyth

EDWARDS	POSSESSION	ACRES	VALUE AND DESCRIPTION	REMARKS
100
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Growing oats at sites around Aberystwyth: Pwllpeiran and Trawscoed



Spreading the seed



Oat Safari: August 2019



<https://www.youtube.com/watch?v=YjoNBMZyPxs&feature=youtu.be>



Acknowledgements

Sandy Cowan, Irene Griffiths and the oat breeding team at Aberystwyth



Thank you