Leaflet Series S. No. 5.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

WELSH PLANT BREEDING STATION.

Aberystwyth-bred

Varieties of Oats and Pure Line Selections of Hen Gymro Wheat

BY

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PRICE - - ONE SHILLING.

1945.

WALKER, PRINTER, SHREWSBURY.

3,000/W.B.W./45.

CEREAL VARIETIES
bred at the
WELSH PLANT BREEDING STATION

By E. T. Jones, M.Sc.

SECTION A. Cereals for Autumn Sowing.

I.—WHITE WINTER OATS.

Varieties S.81, S.147, and S.172.

The production of improved varieties of oats is the main task of the cereal breeding department of the Welsh Plant Breeding Station. No breeding work has hitherto been carried out with barley, and, in the case of wheat, investigations have been restricted to improvements by selection from within the old land variety Hen Gymro, a variety formerly very popular in Wales because of its hardiness and ability to produce reasonably well filled grain of good baking quality under adverse seasonal conditions and on soils of below average fertility.

Winter oats in general are less hardy than winter wheats and the production of varieties more winter-hardy than the old variety Grey Winter will depend on the finding or production of parental material with a higher degree of hardiness than Grey Winter as a basis for breeding purposes. As a high degree of hardiness is an essential safeguard in varieties to be grown on soils of low fertility, the cultivation of winter varieties both old and new should mainly be confined under most conditions prevailing in Wales to well drained soils of average or above average fertility and to the less exposed situations; winter killing being generally more severe and recovery less effective when the soil is not in good heart.

Time of sowing is an important factor in securing the minimum degree of loss through winter killing. Under most conditions winter oats withstand the winter best when sown about the third week of September to the end of the first week of October, when a seed rate of about 1½ cwt. per acre is generally used. Quite good results may be obtained on well-drained soils in sheltered positions from sowings made in November, provided a sufficiently dry seed-bed can be prepared, but the risks of damage by vermin and severe early frosts are greater. For these later sowings it is advisable that the seed rate should be increased to about 200 lb. per acre. In mild open winters on rich, dry soils the lower seed rate is, however, generally regarded as adequate.

The breeding of new hardy varieties of oats for sowing in the autumn has in the past received relatively little attention as compared with that given to varieties for sowing in the spring. Three new varieties have recently been placed on the market by the Welsh Plant Breeding Station, and from breeding work now in progress there is every reason to believe that further substantial improvements in varieties combining a high degree of resistance to lodging with high grain yield and good quality grain will be forthcoming in the not distant future. In this respect recent crosses made between the new varieties S.147 and S.172 and others of related type show very distinct promise.

Aberystwyth S.81.—Introduced in 1931. This was the first variety of winter oats to be placed on the market by the Welsh Plant Breeding Station. It was derived from a cross between Grey Winter and Kyko made in 1920. The grain is white, of medium size and good average quality, with a husk content very similar to that of the well-known spring variety Victory, although in shape the grain presents a smaller and less plump appearance. As a variety for soils of average fertility, it is more resistant to lodging than Grey Winter, and in three years' trials at the several sub-stations of the N.I.A.B., Cambridge, gave consistently good grain yields, and on the average from 10 to 12 per cent. more grain than Grey Winter. The ear is open and of medium size, emerging a few days later than, and ripening at about the same time as the latter variety. In winter hardiness it approaches closely to the Grey Winter parent and, like it, has a very high degree of resistance to attack by stem eelworm. This soil pest, however, is not of general occurrence throughout the country, and is mainly restricted to certain tillage areas. On fields where infestation has previously occurred it is advisable to sow a stem eelworm resistant variety, and for this purpose the variety S.81 can safely be recommended.

Descriptive Features.—Panicle smaller and less open than in S.147 with shorter internodes and a tendency for the spikelets of the lower whorl to be sparse, often with only one or two grains on some of the branches; rachis fairly stiff, straight and erect; branches not long, fairly stiffly horizontal or slightly ascending. Spikelets slender, slightly smaller than in S.147, two-grained with singles at the lower portions of the ear. Awns rare. Base of lower grain with two small lateral tufts of very short fine hairs. Grain medium in size with the second not very well developed, white and generally without any creamy tinge. Straw fairly stout, of good feeding quality, nearly equal to S.147 in length, with the last leaf before ear emergence tending to stand erect.

Husk percentage	..	..	25 to 27.
Weight per 1,000 grains	..	..	about 34 to 37 grm.

Aberystwyth S.147.—The first stock of this variety was placed on the market in the autumn of 1938. Compared with S.81, it is equal in winter hardiness, more resistant to lodging, higher in kernel yield and produces grain superior in size, colour and milling quality.

Produced by a cross made in 1924 between Grey Winter and Marvellous, this new variety has inherited in large measure the winter hardiness, high kernel content and open panicle type of the winter parent together with the good strength of straw, larger grain size, grain colour and high grain yielding ability of the Marvellous parent. It is for these reasons one of the most attractive varieties of white winter oats which have been placed on the market. The ear is open, medium to medium-large in size, and ripens at about the same time as Grey Winter. The variety S.147 is not resistant to stem eelworm attack and on fields known to be infested with stem eelworm preference should be given to S.81, but under all other conditions choice should be made in favour of the variety S.147 on account of its better strength of straw, higher grain yielding ability and superior quality grain. As a white winter oat the variety S.147 is second to none in respect of both grain yield and grain quality. It is specially recommended for sowing on well drained soils of good or average fertility where the grain yield expectation is from 18 to 36 cwt. per acre. Compared with Grey Winter, its superiority in yield of grain is from 15 to 20 per cent. under conditions of average fertility and rather more on soils of higher than average fertility.

Descriptive Features.—Straw nearly equal in length to Grey Winter, stouter and more resistant to lodging ; panicle open, medium to large in size with stiffer and more erect branches ; one branch, in the fifth and seventh whorls respectively, frequently ascends at an angle of 45° to the rachis, and is most marked soon after ear emergence is completed. Glumes, in the early heading period, silvery green in contrast to a more yellowish green in Grey Winter. Spikelets generally two-grained, apical ones occasionally with three, singles rare. Base of lower grain with two small lateral tufts of very short fine hairs. Lower grains occasionally awned. Ripe grain slightly larger than in Grey Winter, creamy-white in colour, with seconds well-developed and of good girth, giving a low proportion of " tail " corn and a high yield of saleable grain.

Husk percentage	22 to 24.
Weight per 1,000 grains	about 38 to 42 grm.

Aberystwyth S.172.—This winter oat should be regarded as a special purpose variety bred for soils of high fertility where straw growth is generally excessive and the more usual types of oats all too frequently get badly lodged. Under these conditions shortness and stiffness of straw and high lodging resistance, rather than inherent grain yielding ability, are factors which largely determine the actual grain yields which can be obtained and the likelihood of producing a grain sample of reasonably good marketable quality. The new variety S.172 was bred from a cross between two white-grained selections respectively derived from the offspring of the crosses Grey Winter × Kyko and Grey Winter × Bountiful, and was first placed on the market in 1939. The ear, which is of medium size, open and dense, is carried on a relatively short and very stiff straw which grows to a height only three-fifths of that of Grey Winter. The grain is

white, and rather small with a moderately thin husk, but when well-filled compares favourably with that of Victory in feeding quality. On soils of good fertility, its total yield of grain is on the average 8 to 10 per cent. superior to Grey Winter, while on rich soils the margin in its favour may be as much as 30 per cent. or more.

Because of its relative shortness of straw and high tillering capacity it is not generally advisable to graze S.172 with stock in the spring except on very rich soils retentive of moisture.

S.172 is recommended for soils where the general yield expectation is from 25 to 45 cwt. per acre, and its relatively short, stiff straw should under these conditions make it a popular variety for grain production as well as for harvesting with a combine harvester. In hardiness and time of maturity it closely resembles the variety S.147.

Descriptive Features.—Readily distinguished by its short very stiff straw, which is about $\frac{3}{5}$th the length of that of Grey Winter. Panicle open, of medium size with short, stiff and mainly horizontal or very slightly ascending branches; basal whorl generally consists of one long branch and one or two short ones at about right angles to the long one. Spikelets small, uppermost and outermost two-grained, inner and lower generally single-grained; single grains fairly numerous in the less well developed ears. Grain rather small, pointed, usually free of awns, with a few medium long, very fine hairs at the base of the lower grain, or none.

Husk percentage	24 to 26.
Weight per 1,000 grains	about 32 to 34 grm.

II.—HEN GYMRO WHEAT.

Pure Line Selections S.70 and S.72.

The two pure lines described below were bred and selected by Dr. T. J. Jenkin from amongst 265 original selections taken from commercial stocks of Hen Gymro, and which after trials for grain yield were marketed in 1928 as improved strains of Hen Gymro wheat. Compared with the latter, they are more uniform in type and superior in grain yielding capacity. These new strains are recommended for sowing on soils of lower fertility than is required for good crops of Standard Red wheat. In hardiness and general straw characteristics they closely resemble the old Hen Gymro stock, and when grown in exposed situations maintain a good dense growth and give better yields than Standard Red. These wheats in spite of their rather weak but flexible straw have the great advantage on land of relatively poor quality of being able to ripen a relatively good grain sample under poor ripening conditions. Good standing crops are, however, frequently grown on the better types of soil in the drier areas where the soil is firm, dry and stony, and does not naturally tend to an over-production of straw. Because of their lateness in ripening, these new wheats should be sown towards the end of September or early in October.

Hen Gymro S.70.

Descriptive Features.—Beardless ; chaff white or pale red ; hairy. Straw long but relatively stiff. On the average has outyielded Standard Red by 10 per cent. Grain red, small as compared with Standard Red at its best, but rather large for Hen Gymro. Ripens well under adverse conditions, but somewhat later than ordinary Hen Gymro.

Hen Gymro S.72.

Descriptive Features.—Beardless ; chaff white, smooth. Straw shorter and rather weaker than S.70. On the average has outyielded Standard Red by 11 per cent. Grain red, smaller than Standard Red but relatively large for Hen Gymro. Suits lighter soils than those on which Standard Red is at its best, and is later ripening.

SECTION B.—Oats for Spring Sowing.

I. For soils of good fertility : S.84.
II. For soils of average fertility : S.175 and S.220.
III. For soils of below average fertility : S.79.
IV. For soils of low fertility : S.171 and S.75.

Of varieties of oats for sowing in the spring, the range of types is greater than in autumn-sown oats, and hardy, high tillering varieties which succeed well on the poorer kinds of soils are available. Until comparatively recent times cereal breeders have given most of their attention to the breeding of new varieties for the better soils, mainly because of the larger acreage which is likely to profit thereby, and in part because the task is in some respects rather less difficult. The breeding of spring-sown varieties for the poorer levels of fertility has, however, received much attention at the Welsh Plant Breeding Station, and while progress has been slower than in the breeding of strains for the better soils, some advances have already been made.

Attempts to grow early maturing, high grain-yielding varieties on poor unimproved upland fields have not in general met with any appreciable measure of success. This is due to the greater demand which such varieties make upon the available plant food in the soil and their greater dependence on climatic conditions favourable to rapid growth in the pre-heading period. It is only after the fertility of such fields has been improved by suitable pre-treatments, balanced manuring and drainage, where necessary, that reasonable hopes of the successful cultivation of early grain-yielding varieties can be entertained. Until such improvements have been effected the varieties most likely to give reasonably sure crops from season to season under adverse cultural conditions are the relatively late maturing, high tillering and straw producing types such as *Ceirch-du-bach, Ceirch Llwyd Cwta, S.*171 and *Avena strigosa* (*Ceirch Llwyd*).

It was with the aim of breeding hardy and comparatively early grain-producing varieties for *improved* upland soils, as well as for lowland fields of average cropping capacity, that crosses were made several years ago between Victory and Radnorshire Sprig and other

hardy spring varieties. One new variety, S.175, which was derived from a cross between Victory and Black Bell III has already been placed on the market ; limited stocks of seed of a further new variety, namely, S.220, derived from crossing Radnorshire Sprig with Victory will be available for marketing in the spring of 1945, while certified seed of a sister strain of this cross, Maldwyn (S.221), should be forthcoming in the near future.

With varieties possessing increased earliness and reduced length of straw it is essential for the production of a good weight of sheaf that sowing of the seed should be carried out as early in the spring as favourable weather and the production of a good seed bed permit. Excessive earliness on the one hand and excessive lateness on the other should be equally discouraged. A small dressing of nitrogen in addition to the usual application of phosphate greatly assists in the development of strong, vigorous seedlings, and reduces seedling mortality when crops are sown early. This is a practice which could with advantage be extended on the drier soils of average or below average fertility.

I.—FOR SOILS OF GOOD FERTILITY (yield expectation 20—36 cwt. per acre).

Aberystwyth S.84.—Initial seed stocks of this variety were placed on the market in the spring of 1938. The chief aim in the breeding of S.84 was to secure resistance to lodging greater than that possessed by any varieties then on the market. This object has been achieved and the wide popularity which this variety has gained when grown on good fertile soils has fully established its position in this respect. S.84 was bred by repeated selection from the offspring of a cross made in 1921 between the varieties Victory and Red Algerian. The ear is open and dense and gives high yields of plump grain and a low proportion of 'tail' corn ; percentage husk is similar to, or very slightly higher than, that of the Victory parent, while in strength of straw it is markedly superior. The young plants tiller well, which gives the variety a considerable degree of hardiness and a high power of resistance to wireworm attack. When sown early in spring, S.84 ripens at approximately the same time as, or only a few days later than Victory, but should inferior seed be sown or sowing be carried out late in the spring, maturity in wet seasons may be seriously delayed. Sufficient seed should be sown to check tillering and facilitate early ripening. On warm soils in good heart from 170 to 190 lb. per acre should be used, and on cold heavy soils the rate should be increased to 200—220 lb. when the seed is broadcast. A well-graded seed sample dusted with an organo-mercuric dust should always be used. Early sowing gives added resistance to lodging, a higher grain to straw ratio, higher yields and a better quality grain. When weathered in the stook the grain of S.84 often assumes a buff tinge ; this discoloration does not, however, interfere with the germination and vigour of the seed provided the grain is harvested in a sound and dry condition.

Descriptive Features.—Straw of good length, medium stout without being coarse ; stems even in length giving a very level top to the crop. Last leaf erect at time of ear emergence. Leaf sheath and leaf margins glabrous. Panicle sub-equilateral, dense, with a tendency to develop blind spikelets at the base, especially after a dry spring on light shallow soils. Spikelets numerous and two-grained ; three-grained apical spikelets very rare. Grain medium in size, urn-shaped ; from 11 to 13 mm. long and from 2.6 to 3.6 mm. wide ; short and plump with obtuse apex ; white in colour with a tendency to become buff when weathered or over-ripe. Awns rare. Ears emerge a few days later than most other white heavy-grained spring varieties, and the leaves and straw tend to remain green to within a short time of the grain being ripe.

Husk percentage	26 to 28.
Weight per 1,000 grains	about 34 grm.

II.—FOR SOILS OF AVERAGE FERTILITY (yield expectation 14 to 24 cwt. per acre).

Aberystwyth S.175.—Marketed in 1938 and produced from a cross between Victory and the hardy Swedish oat Black Bell III, this variety is recommended for land of average cropping capacity and areas which are described as good 'barley and sheep land.' It succeeds well on dry, stony soils in reasonably good heart. The grain is white and of good size, and although somewhat long is of high feeding quality. In grain yield, S.175 compares favourably with Radnorshire Sprig, ripens only a few days later and produces longer and stiffer straw, which is readily consumed by stock. On account of its high straw-producing capacity, it should not be sown on heavily dunged soils or on old land possessing a deep, moist or peaty type of soil. The panicle is one-sided with very regular two-grained spikelets. As the grain is of good size and the tillering capacity low, it should be sown at not less than 200 to 220 lb. per acre.

Descriptive Features.—The variety S.175 is easily identified by its one-sided panicle and long straw which stands erect. Spikelets regularly two-grained ; grain white, rather long, slightly long-pointed, generally well filled, low in husk with a relatively long, clean kernel. Leaf sheaths and leaf margins glabrous.

Husk percentage	24 to 26.
Weight per 1,000 grains	about 37 grm.

Aberystwyth S.220.—This is a new black-grained variety, derived from a cross betwen Victory and Radnorshire Sprig, of which limited stocks of certified seed will be placed on the market in the spring of 1945. It is a hardy, good tillering variety which ripens fairly early and is bred for soils of average or below average cropping capacity. The straw is of medium length, medium-fine but slightly longer, stouter and rather more resistant to lodging than that of its Radnorshire Sprig parent. A reliable cropper giving on soils of only moderate fertility high yields of grain of good average quality and a good grain to straw ratio.

Descriptive Features.—Straw medium long, medium fine but slightly longer and stouter and more resistant to lodging than in Radnorshire Sprig, and rather less leafy. Leaf sheaths and leaf margins glabrous. Panicle open, of good size and medium dense. Ear emergence about two days later than in Radnorshire Sprig. Spikelets two-grained, some apical ones with three grains. Grain black, fairly long, somewhat long-pointed, of good size. Rachilla glabrous.

Husk percentage	26 to 28.
Weight per 1,000 grains	about 32 grm.

III.—FOR SOILS OF BELOW AVERAGE FERTILITY (yield expectation 12 to 16 cwt. per acre).

Ceirch-du-bach S.79.—This variety was obtained by pure line selection from the old land variety *Ceirch-du-bach* by Mr. Martin G. Jones, and was placed on the market in 1931. The commercial samples of *Ceirch-du-bach* are of a composite character and consist of a mixture of strains differing from each other in length and strength of straw, size of grain and grain-yielding capacity. The new strain S.79 is one of a number of such strains which were initially selected and in yield testing trials it was found to be a week earlier in ripening and to produce on the average from 5 to 9 per cent. more grain than the original parent variety. In addition, its straw is shorter, slightly stouter and less liable to lodge. S.79 is therefore recommended as an improved *Ceirch-du-bach* for soils similar to those on which the old variety is generally grown.

Descriptive Features.—Grain black, short, plump and rather small with a whitish tip. Basal hairs few to many, brownish and slightly tufted. Spikelets frequently single-grained bearing a conspicuous rudimentary second flower. Panicle fairly large and spreading. Young plants with narrow leaves, hardy, and tillering freely. Leaf sheaths and leaf margins glabrous. Seed stocks of this variety are now in short supply.

IV.—FOR SOILS OF LOW FERTILITY (yield expectation 10 to 14 cwt. per acre).

Ceirch Llwyd Cwta S.171.—This variety is an improved form of *A. strigosa*, an oat widely grown on many upland farms in various parts of Wales and known variously as *Blewgeirch*, *Ceirch Llwyd*, *Ceirch Teify*, or Brown Oats. It has been bred for soils of low productive capacity similar to those on which *A. strigosa* is normally grown, and was first placed on the market in 1936. Derived from a cross between *Avena strigosa* and *Avena brevis*, it has inherited the hardy, high tillering, leafy characteristics of *Avena strigosa* and the improved type of grain typical of *A. brevis*. It is essentially a fodder producing variety and for stock feed should be cut before the crop is completely mature, when the full benefit of its fine straw is obtained. The grain is small, of a dark grey colour, possesses a thin husk, and is highly resistant to mildew and smut. Compared with the heavy grained varieties of oats, it contains in the grain a higher

proportion of protein and oil, and for this reason makes a good feed for young growing stock. Its high tillering capacity enables it to produce a denser growth, and in consequence a higher grain yield than the bigger-grained oat varieties on soils of comparatively low fertility. It leaves a clean stubble at harvest time, which is a factor of much value on upland farms where weather conditions are generally unfavourable for cleaning the land and a weedy undergrowth may prove troublesome. On good soils straw growth with this variety is too abundant, and its use should therefore be restricted to soils of below average fertility.

Because of the smallness of its grain, it should be sown on a firm, fine and comparatively shallow seed bed, at a seed rate of 130 to 140 lb. per acre. If sown broadcast on the furrows, it is advisable to harrow or roll before sowing unless the ploughing has been carried out early and the furrows have mellowed down and become firmly set. If buried too deeply seedling vigour is checked and the seed will not produce a strong and even braird.

S.171 can be successfully used as a second straw crop on soil of average or slightly below average fertility on many semi-lowland farms. Under these conditions grain yields of 16 to 20 cwt. per acre and maximum weed suppression can be obtained using a seed rate of 120 to 130 lb. per acre. Sowing in most seasons should be carried out towards the end of March or early in April.

In contrast to *A. strigosa* the grain of S.171 can be sown with a seed drill, and also when threshed can be used for grinding into meal.

Descriptive Features.—Straw abundant, long, fine, clean and leafy, becoming fibrous when over-ripe. Leaves narrow, slightly yellowish-green in colour. Panicle open, lower branches spreading rather widely. Spikelets two-grained, occasional singles at the base of ear. Grain dark grey in colour, glabrous, shorter than *A. strigosa* with much reduced awn on both grains. The awn frequently breaks off in threshing when the grain is fully ripe. Grain apex with two short projections. Highly resistant to smut. Readily distinguished from *A. strigosa* by its more open head, reduced size of awns, and higher bushel weight.

Husk percentage	24 to 26.
Weight per 1,000 grains	about 13 grm.

Ceirch Llwyd S.75.—This is a pure line selection of *A. strigosa*, and is highly resistant to smut. The grain is pale grey in colour and of the *Ceirch Llwyd* type. On account of the strongly awned character of the grain, it can be sown broadcast on a less well prepared seed bed than *Ceirch Llwyd Cwta S.*171, as there is less danger of the seed becoming too deeply buried in the soil. It gives high yields of excellent leafy fodder on the poorest classes of soils and a seed-rate of 120 to 130 lb. per acre is generally adequate. Owing to the presence of awns on the grain this variety cannot be satisfactorily sown with a drill. The grain is longer and lighter than that of S.171, and carries a slightly higher percentage of husk, but gives rather better forage yields on the very poorest types of soils.

APPENDIX.

SEED SUPPLIES.

Farmers are advised to purchase CERTIFIED seed in SEALED BAGS through their merchants, from the following Seed Growers' Associations, which are operating the Inspection and Certification Schemes adopted by the Welsh Federation of Seed Growers' Associations as at December, 1944:—

Seed Growers' Association.	Autumn Varieties.	Spring Varieties.
Clarach-Valley Seed Growers' Association, 11, Alexandra Road, Aberystwyth, Cards.	S.70 ; S.72	S.84 ; S.175 ; S.171 ; S.220 ; S.75 ; S.79.
Hay-Talgarth Seed Growers' Association, Cloverley, Garth Road, Builth Wells, Breconshire ..	S.147 ; S.172	S.84 ; S.220
Monmouthshire Seed Growers' Association, Agricultural Institute, Usk, Mon.	S.147 ; S.172	S.84
Powysland Seed Growers' Association, Agricultural Office, Newtown, Mont.	S.147	S.84
Pembrokeshire Seed Growers' Association, 11, Alexandra Road, Aberystwyth	—	S.84
Glamorgan Seed Growers' Association, 7, Fitzalan Place, Cardiff	S.147	S.84
Vale of Clwyd Seed Growers' Association, Station Road, Ruthin	S.147 ; S.172	S.84
Caernarvonshire and Anglesey Seed Growers' Association, Memorial Buildings, Bangor ..	—	S.84
Carmarthenshire Seed Growers' Association, Mount Pleasant, Llanginning, St. Clears, Carms...	—	S.84 ; S.220

Merchants should in case of difficulty in obtaining supplies of CERTIFIED seed apply to The Secretary, Welsh Federation of Seed Growers' Associations, 11, Alexandra Road, Aberystwyth.