

Plant		Barley		429	Primary essential character	
No	Characters	No. of samples	Methods	Rank or measurement unit		Remarks
1	Plant habit	Block	Observation	2:Erect 3:Nearly erect 4:Semi-erect 5:Intermediate 6:Semi-prostrate 7:Nearly-prostrate 8:Prostrate		Plant type before the initiation of internode elongation (January to February). In the district of long snow cover, growth habit is observed before snow cover.
2	Plant type	Block	Observation	2:Normal 8:Uzu		Classified by length and tip shape of coleoptile
3	Culm length	10 plants	Measurement	cm (integer)		Length from ground level to the ear neck of the longest culm
4	Ear length	10 plants	Measurement	cm (round to the 1st decimal place)		Length from ear neck to the top of ear of the longest culm
5	Kernel rows	Block	Observation	2:Two-rowed 5:Coarse six-rowed 8:Six-rowed		Rows of spikelets
6	Existence of awn	Block	Observation	0:Awnless 2:Very scarce 3:Scarce 4:Slightly scarce 5:Intermediate 6:Slightly abundant 7:Abundant 8:Very abundant		Scarce=10%, intermediate=25%, abundant=40%
7	Glume color	Block	Observation	1:Light yellow 2:Yellow 3:Yellowish brown 4:Brown 5:Brownish red 6:Red 7:Reddish purple 8:Purple 9:Deep purple - Black		Glume color at maturity
8	Grain size	Block	Observation	2:Very small 3:Small 4:Slightly small 5:Intermediate 6:Slightly large 7:Large 8:Very large		Grade of grain size
9	Grain color	Block	Observation	0:White 1:Light yellow 2:Yellow 3:Yellow brown 4:Brown 5:Reddish brown 6:Red 7:Reddish purple 8:Purple 9:Dark purple		Color of grain for naked barley
10	Covered or naked kernels	Block	Observation	2:Covered kernels 8:Naked kernels		Classified by detachability of glume
11	Heading date	Block	Observation	date		Date when 40-50% ears have emerged
12	Maturity date	Block	Observation	date		Date when ear necks more than 80% of all ears turn yellow and grains become as hard as wax

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13	1000 grain weight	3 replications	Measurement	2:Very light 3:Light 4:Slightly light 5:Intermediate 6:Slightly heavy 7:Heavy 8:Very heavy	Conversion to 1000 grain weight after counting of grains with 20 gram samples (grain moisture: 12.5%)

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1	Culm angle	Block	Observation	2:Very close 3:Close 4:Slightly close 5:Intermediate 6:Slightly open 7:Open 8:Very open		Culm angle at the full heading time to maturity. Open type shows a large angle
2	Culm thickness	Block	Observation	2:Very thin 3:Thin 4:Slightly thin 5:Intermediate 6:Slightly thick 7:Thick 8:Very thick		Thickness of culm at maturity
3	Culm stiffness	Block	Observation	2:Very stiff 3:Stiff 4:Slightly stiff 5:Intermediate 6:Slightly tender 7:Tender 8:Very tender		Stiffness of culm at maturity
4	Culm waxiness	Block	Observation	0:Absent 2:Very scarce 3:Scarce 4:Slightly scarce 5:Intermediate 6:Slightly abundant 7:Abundant 8:Very abundant		Degree of culm waxiness in the upper first internode at heading time
5	Presence of auricle	Block	Observation	0:Absent 9:Present		
6	Leaf color	Block	Obs.&Measr.	2:Very light 3:Light green 4:Slightly light 5:Green 6:Slightly dark 7:Dark green 8:Very dark		Leaf color at tillering stage and booting stage or at observation time of growth habit
7	Leaf sheath waxiness	Block	Observation	0:Absent 2:Very scarce 3:Scarce 4:Slightly scarce 5:Intermediate 6:Slightly abundant 7:Abundant 8:Very abundant		Degree of waxiness on the upper first leaf sheath at heading time
8	Leaf sheath pubescence	Block	Observation	0:Absent 2:Very scarce 3:Scarce 4:Slightly scarce 5:Intermediate 6:Slightly abundant 7:Abundant 8:Very abundant		Degree of leaf sheath pubescence
9	Spike configuration	Block	Observation	2:Parallel 3:Slightly parallel 4:Slightly parallel-Intermediate 5:Intermediate 6:Intermediate-somewhat pyramidal 7:Slightly pyramidal-Pyramidal 8:Pyramidal		
10	Spikelet density	10 spikes	Obs.&Measr.	2:Very sparse 3:Sparse 4:Slightly sparse 5:Intermediate 6:Slightly dense 7:Dense 8:Very dense		Number of internodes in rachis (=number of total spikelets - 1)/rachis length (cm)
11	Ear protrusion	5 spikes	Measurement	2:Very short 3:Short 4:Slightly short 5:Intermediate 6:Slightly long 7:Long 8:Very long		Length of the top of flag leaf sheath to spike neck at maturity

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12	Spike blade angle	Block	Observation	2:Erect 3:Nearly erect 4:Semi-erect 5:Intermediate 6:Semi-drooping 7:Nearly-drooping 8:Drooping		Degree of spike drooping at maturity
13	Awn length	10 spikes	Obs.&Measr.	2:Very short 3:Short 4:Slightly short 5:Intermediate 6:Slightly long 7:Long 8:Very long		Measurement of the longest 10 awns. Classification compared with standard cultivars
14	Roughness of awn	Block	Observation	2:Very smooth 3:Smooth 4:Slightly smooth 5:Intermediate 6:Slightly rough 7:Rough 8:Very rough		Degree of awn smoothness
15	Hooded awn type	Block	Observation	2:Short hooded awn 5:Hooded awn 8:Long hooded awn		Classified by length of hooded awn
16	Grain shape	Block	Obs.&Measr.	2:Very round 3:Round 4:Slightly oval 5:Oval 6:Slightly slender 7:Slender 8:Very slender		Evaluation based on the ratio of length and width of grain
17	Fineness of husk	Block	Observation	2:Very thin 3:Thin 4:Slightly thin 5:Intermediate 6:Slightly thick 7:Thick 8:Very thick		Judgment by the degree of wrinkling on husk. A wrinkly husk=thin
18	Rachilla hair length	Block	Observation	2:Short 5:Intermediate 8:Long		Observation for malting barley
19	Transverse crease in the lemma base	Block	Observation	0:Absent 9:Present		Presence of transverse crease in the lemma base of grain for malting barley
20	Width of ventral crease	Block	Observation	2:Very narrow 3:Narrow 4:Slightly narrow 5:Intermediate 6:Slightly wide 7:Wide 8:Very wide		Observation for malting barley
21	Lodicule hair length	Block	Observation	2:Short 8:Long		Observation for malting barley
22	Intensity of anthocyanin coloration of flag leaf auricles	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly strong 7:Strong 8:Very strong		Intensity of anthocyanin coloration of flag leaf auricles
23	Frequency of plants with recurved flag leaves	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly high 7:High 8:Very high		Frequency of plants with recurved flag leaves

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24	Glaucosity of flag leaf sheath	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly high 7:High 8:Very high		Glaucosity of flag leaf sheath
25	Intensity of anthocyanin of awn tips	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly strong 7:Strong 8:Very strong		Intensity of anthocyanin of awn tips
26	Glaucosity of ear	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly strong 7:Strong 8:Very strong		Glaucosity of ear at flowering to milky stage
27	Attitude of ear	Block	Observation	2:Erect 3:Nearly erect 4:Semi-erect 5:Intermediate 6:Semi-drooping 7:Nearly drooping 8:Drooping		Attitude of ear at milky stage
28	Length of first segment rachis	Block	Measurement	2:Short 5:Intermediate 8:Long		Length of first segment rachis at maturity stage
29	Curvature of first segment rachis	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly strong 7:Strong 8:Very strong		Curvature of first segment rachis at maturity stage
30	Development of sterile spikelets	Block	Observation	2:Non 5:Rudimentary 8:Full		Development of sterile spikelets at maturity stage
31	Attitude of sterile spikelet	Block	Observation	2:Parallel 5:Weakly divergent 8:Divergent		Attitude of sterile spikelet in mid-third of ear at maturity stage
32	Length of glume and its awn relative to grain	Block	Observation	2:Shorter 5:Equal 8:Longer		Length of glume and its awn of median spikelet relative to grain at maturity stage
33	Rachilla hair type	Block	Observation	2:Short 8:Long		Rachilla hair type
34	Anthocyanin coloration of nerves of lemma	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly strong 7:Strong 8:Very strong		Anthocyanin coloration of nerves of lemma at dough ripe stage

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35	Spiculation on inner lateral nerves of dorsal side on lemma	Block	Observation	0:Absent 2:Very weak 3:Weak 4:Slightly weak 5:Intermediate 6:Slightly high 7:High 8:Very high		Spiculation on inner lateral nerves of dorsal side on lemma at maturity stage
36	Hairiness of ventral furrow	Block	Observation	0:Absent 8:Present		Hairiness of ventral furrow at maturity stage
37	Disposition of lodicules	Block	Observation	0:Frontal 8:Clasping		Disposition of lodicules at maturity stage
38	Color of aleurone layer	Block	Observation	2:Whitish 5:Weakly colored 8:Strongly colored		Color of aleurone layer at dough ripe stage

Plant		Barley		429	Secondary essential character	
No	Characters	No. of samples	Methods	Rank or measurement unit		Remarks
1	Grade of spring habit	10 plants	Obs.&Measr.	1:1 2:2 3:3 4:4 5:5 6:6 7:7		Observation of heading performance after seeds were sown at a constant interval (usually days) from February to April. Accession with high spring habit is classified as 1, with high winter habit is classified as 7.
2	Glutinous or non-glutinous endosperm	Block	Observation	2:Non-glutinous 8:Glutinous		Distinction of glutinous or non-glutinous endosperm based on reaction potassium iodide
3	Awn hulling	Block	Observation	2:Very difficult 3:Difficult 4:Slightly difficult 5:Intermediate 6:Slightly easy 7:Easy 8:Very easy		Investigation at maturity for covered barley
4	Hulling	Block	Observation	2:Very difficult 3:Difficult 4:Slightly difficult 5:Intermediate 6:Slightly easy 7:Easy 8:Very easy		Investigation at maturity for covered barley
5	Threshability	Block	Observation	2:Very difficult 3:Difficult 4:Slightly difficult 5:Intermediate 6:Slightly easy 7:Easy 8:Very easy		Investigation at maturity
6	Lodging resistance	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Synthetic judgment based on the stage of lodging occurrence and degree of lodging
7	Yellow mosaic resistance	10 plants, 2 replications	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by disease symptom around internode elongation stage and uniformity of heading (middle and southern parts of Japan)
8	Scab resistance	30 plants, 4 replications	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the degree of disease infection at dough ripe stage to maturity
9	Powdery mildew resistance	50 plants, 2 replications	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the degree and spread of disease symptoms at ripening stage

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1	Leaf rust resistance	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the degree and extension of disease symptom at ripening stage
2	Leaf blotch resistance	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the degree and extension of disease symptom at ripening stage
3	Time of internode elongation	Block	Observation	2:Very early 3:Early 4:Slightly early 5:Intermediate 6:Slightly late 7:Late 8:Very late		Observation of internode elongation at the end of January to the beginning of April (middle and southern part of Japan)
4	Sprouting resistance	5 spikes	Measurement	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Sprouting of matured spikes under wet condition
5	Cold tolerance	100 plants, 2 replications	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the rate of winter-killing and the degree of damage after overwintering (northern part of Japan)
6	Snow mold tolerance	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Judgment by the degree of plant damage after snow melting (snow falling area)
7	Tolerance to moisture	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Endurance under wet condition (note observation stage)
8	Tolerance to soil upheaval	40 plants, 4 replications	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Tolerance to upheaval against frozen soil. Synthetic judgment by the rate of survived plants at two investigation times
9	Resistance to insect pests	Block	Observation	2:Very high 3:High 4:Slightly high 5:Intermediate 6:Slightly low 7:Low 8:Very low		Note insect name

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1	Yield	Block	Obs.&Measr.	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Comparison weight of whole-grains per area with standard cultivars
2	Test weight	3 replications	Measurement	2:Very light 3:Light 4:Slightly light 5:Intermediate 6:Slightly heavy 7:Heavy 8:Very heavy		Weight of 1 liter (grain moisture: 12.5%). Measure 3 times using liter weight vessel.
3	Grain quality	Block	Observation	1:Excellent 2:Very good 3:Good 4:Slightly good 5:Intermediate 6:Slightly poor 7:Poor 8:Very poor 9:Extremely poor		Synthetic judgment of appearance of grain based on fullness, uniformity of size and shape, bright color of grains
4	Glassiness of grain	Block	Obs.&Measr.	3:Powdery 4:Slightly powdery 5:Intermediate 6:Slightly glassy 7:Glassy		Measurement of percentage of glassy kernel. Powdery:<=30% glassy, intermediate:30-70% glassy, glassy:>=70% glassy
5	Whiteness of grain	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Measurement of grains with a colormeter, grains are put through 1.8 mm sieve
6	Pearled grain yield	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Grains are pearled with a grinder, weight ratio of pearled grain to grain (except for malting barley)
7	Whiteness of pearled grain	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Measurement of pearled grains with a colormeter (except for malting barley)
8	Plump-grain percentage	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		200 gram samples are passed through 2.5 mm sieve for 5 minutes. Weight ratio is measured.
9	Steeping time	Block	Measurement	2:Very short 3:Short 4:Slightly short 5:Intermediate 6:Slightly long 7:Long 8:Very long		Reaching time to 43% grain moisture under water (for malting barley)
10	Malt yield	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Weight ratio % of malt to grain in dry weight (for malting barley)

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11	Malt extract	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Weight ratio % of soluble extract to malt (malting barley), measurement by specific gravity of wort
12	Available extract	Block	Calculation	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Malt extract x Malt yield (for malting barley)
13	Protein content of malt	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Percentage of total nitrogen content in malt x 6.25 (for malting barley)
14	Soluble nitrogen content of wort	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Measurement for malting barley
15	Kolbach index	Block	Calculation	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		(Soluble nitrogen content of wort/Total nitrogen content of malt) x 100 (for malting barley)
16	Diastatic power	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Measurement by starch reaction with enzyme extracted from malt (for malting barley)
17	Diastatic power per total nitrogen	Block	Calculation	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Diastatic power/Total nitrogen of malt (for malting barley)
18	Apparent final attenuation	Block	Measurement	2:Very low 3:Low 4:Slightly low 5:Intermediate 6:Slightly high 7:High 8:Very high		Calculation based on fermentable carbohydrate of malt extract fermented by yeast in wort
19	Wort color	Block	Measurement	2:Very light 3:Light 4:Slightly light 5:Intermediate 6:Slightly dark 7:Dark 8:Very dark		Measurement of wort color with EBC color desk (for malting barley)

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1	Grain hardness	Block	Measurement	2:Very soft 3:Soft 4:Slightly soft 5:Intermediate 6:Slightly hard 7:Hard 8:Very hard	Measurement of grain hardness using Single Kernel Characterization System (SKCS)