

## Iranian Wheat Landrace Accession Database (IWLADB)

<http://biogeo.ucdavis.edu/projects/iranwheat/>

### General Information

This document describes a database that presently consists of 16,907 records representing observations on subsets of a collection of wheat landraces from Iran and local check varieties for reference in seven experiments carried out at the University of California, Davis (UC Davis) over the course of seven years. In addition to observations and measurements made for the Iranian landrace accessions and local check varieties in the experiments, the database includes information about each accession from Iran, including its taxonomic designation, Iranian origin information (city/village and province), and identification numbers from five different organizations that have assembled and screened portions of the collection (the University of Tehran (UT), which assembled the collection, UC Davis, which increased the lines and evaluated them, the USDA National Small Grains Collection at Aberdeen Idaho, which has accessioned most of the collection and screened it for growth habit and disease resistance, and the international agricultural research centers ICARDA and CIMMYT which have accessioned and screened portions of the collection). Each collecting site has been geo-referenced to permit spatial analyses. The database also includes information about check varieties that were interspersed throughout each field planting to permit field-based and year-based analyses. The database is available at <http://biogeo.ucdavis.edu/projects/iranwheat/>.

The Iranian Wheat Landrace Collection was amassed mainly in 1935 from country-wide collections from farmers' fields and market places by a University of Tehran professor. More than 11,000 seed samples (accessions) were sent by UT to UC Davis in five shipments in 1986-87 under the auspices of a USDA/APHIS importation permit. Some accessions were represented by as few as three seeds. All of the accessions were believed to be derived from single plants maintained at the University of Tehran, hence we specify each entity as a 'landrace accession' as distinct from a population of diverse plants characteristic of a landrace. Plants were grown at UC Davis in a greenhouse under conditions specified by USDA/APHIS in the importation permit protocol over two years in sequence as the seeds were received from Iran. Each accession was represented by 2 seeds planted in a 'forestry' tube. Accessions that failed to germinate were replanted once or twice. More than 8,000 accessions were successfully regenerated in the greenhouse and field plantings. Seeds from regenerated accessions were planted in the field in Davis at the University of California Agronomy Farm in the next available planting season. The accessions were planted in single-row plots 2.5 m long with 0.6 m between plots with 20 to 30 seeds per row. Accessions that did not produce sufficient seed from initial field planting for transfer to the genebanks or for subsequent experimentation were replanted in subsequent years. Details for the traits measured each planting are described in the table at the end of this document.

The database is stored in Microsoft Access 2007 (.accdb) format. It consists of five primary tables:

- *accession*, which contains identification numbers and species information about each accession,
- *location*, which describes the locations in Iran from which the accessions were collected,
- *experiment*, which contains the data from field plantings,
- *checks*, which identifies the species and cultivar used as check (local reference) varieties in the field experiments, and
- *field\_info*, which contains information about each UC Davis field planting, including plot size and planting and harvest dates.

### Database Field Identifications

The accession number assigned at UC Davis was of the form IWA 86xxxxx, where the prefix IWA signifies Iranian Wheat Accession, 86 indicates the year of introduction of seed to U.S., 1986, and xxxxx represents the unique five-digit number of an accession. In addition, each check variety used in the field

plantings was assigned an accession number in the unused range 869xxxx. As received, each envelope or packet containing an accession had one or two designations that had been assigned by the University of Tehran: a packet number and an accession number. Accompanying the seed packages were handwritten tables with columns for package number, accession number, origin, species, subspecies, and percent representation. These pages were grouped by province. This information was linked to the seed packages by the packet number and accession number. The UT accession number was typically four digits, a dash, and one or two more digits. The implication was that the four digits represent a single landrace accession from which subsets based on morphology had been segregated and denoted by the dash followed by one or two digits. For example, accession 3456 might have been separated into subsets 3456-1, 3456-2, 3456-3. The values in the origin field were cities or villages. In the species field, the practice varied, sometimes a specific epithet was provided, other times a full species binomial was given. The subspecies field, when used, provided an infraspecific designation that corresponds in some cases to subspecies and in other cases to variety. The percent representation was a value estimating the proportion of a landrace accession (the four-digit number) represented by a subset. For example, 3456-1 might have been 85%, 3456-2 10%, and 3456-3 5%. Unfortunately this practice was not followed consistently throughout the collection.

The taxonomic names provided for most accessions in the information from the University of Tehran appeared to be based on the Vavilov wheat nomenclature system used in the 1930s that attempted to recognize morphological variation with infraspecific categorization (see Vavilov 1940 for a description of the morphological and ecological diversity that this nomenclature system attempted to codify into the Linnaean system). Several species binomials were used at both the hexaploid level and the tetraploid level. Today, we recognize one hexaploid cultivated wheat species, *Triticum aestivum*, and one tetraploid cultivated wheat species, *T. turgidum*. The database contains (1) the two fields as deciphered from the data pages accompanying the seed packages, (2) a suggested interpretation of that, correcting spelling when necessary, and (3) the correspondence with today's *T. aestivum* or *T. turgidum*.

The IWLADB is designed to provide easy extension to include additional data fields, and in fact, it does not yet include some evaluation data collected at Davis, such as Russian wheat aphid reaction and responses to increased soil salinity, nor does it include data collected and published by research organizations, such as nematode resistance, common and dwarf bunt, and reaction to the three rust parasites.

## Database Tables

### 1. Accession Table

Field Name	Description	Comment
<b>UCD_IWA_NO</b>	UC Davis identification number, 86xxxxx	At UC Davis, each accession was given a unique seven-digit identification number including the two-digit prefix 86. In addition, each check variety was assigned a number in the 869xxx range. These numbers are the primary identifier for each accession and check variety throughout the database.
<b>PACK_NO</b>	Seed packet number	As received from the University of Tehran.
<b>UT_ACC_NO</b>	University of Tehran accession identification number	It is not certain that each of these values is unique; thus <b>UCD_IWA_NO</b> is the primary accession identifier.
<b>LOC_ID</b>	Unique location ID	Most accessions were identified with-a province and city (see <b>Location</b> table: <b>UT_PROVINCE</b> , <b>UT_CITY</b> ). This field is used to index each location (unique combination of

		province and city).
<b>USDA_PI_NO</b>	USDA identification number (PI xxxxxx)	Most of the accessions were sent to the USDA National Small Grains Collection and, as part of their accessioning process, were assigned a Plant Introduction number by which it can be tracked in GRIN.
<b>CIMMYT_NO</b>	CIMMYT identification number	Most of the accessions were sent to CIMMYT for permanent storage and international distribution. These accessions were assigned a permanent CIMMYT identification number.
<b>CIMMYT_NO_2</b>	Additional CIMMYT identification numbers	In a few cases, the same accession was sent to CIMMYT more than once and/or a single accession was assigned multiple CIMMYT numbers. CIMMYT numbers beyond the first assigned number are denoted in this field.
<b>ICARDA_NO</b>	ICARDA identification number	Durum accessions were sent to ICARDA and they were assigned an ICARDA identification number.
<b>ICARDA_NO_2</b>	Additional ICARDA identification numbers	In a few cases, the same accession was sent to ICARDA more than once and/or a single accession was assigned multiple ICARDA numbers. ICARDA numbers beyond the first assigned number are denoted in this field.
<b>UT_SPECIES</b>	University of Tehran species identification	The initials given in this field stand for a species binomial interpreted in the field <b>INTERPRETED_SPECIES</b> .
<b>UT_SUB_SPECIES</b>	University of Tehran subspecies identification	Many accessions were identified with a subspecific epithet.
<b>UT_SUB_%</b>	The proportion of the original landrace population as collected from field or market place represented by a variant	Only for some accessions.
<b>INTERPRETED_SPECIES</b>	Interpretation of the abbreviation given in the <b>UT_SPECIES</b> field	Binomial in genus <i>Triticum</i>
<b>CIMMYT_GENUS</b>	CIMMYT genus designation	The genus as confirmed by grow-out at CIMMYT
<b>CIMMYT_SPECIES</b>	CIMMYT species epithet designation	The species epithet as confirmed by grow-out at CIMMYT
<b>ICARDA_GENUS</b>	ICARDA genus designation	The genus as confirmed by grow-out at ICARDA
<b>ICARDA_SPECIES</b>	ICARDA species epithet designation	The species epithet as confirmed by grow-out at ICARDA

## 2. Location Table

Geopolitical changes in Iran from the 1930s to today have resulted in the splitting of originally larger provinces into two or more smaller ones; variable transliterations of place names have resulted in more than one variant for a given place name. The database records this information as transcribed from the incoming packages and papers and provides an interpretation of this information in terms of recent geopolitical changes.

Field Name	Description	Comment
<b>LOC_ID</b>	Unique location ID	Most accessions were identified with a province and city (see <b>Location</b> table: <b>UT_PROVINCE</b> , <b>UT_CITY</b> ). This field is used to index each unique combination of province and city.
<b>UT_PROVINCE</b>	Iranian province	Designated by the University of Tehran as geographical source of the accession
<b>UT_CITY</b>	Iranian city or other locality	Designated by the University of Tehran as geographical source of the accession
<b>INTERPRETED_PROVINCE</b>	Modern Iranian province (as of 2011)	The assessment of the corresponding modern province as derived from multiple internet gazetteer resources.
<b>INTERPRETED_LOCALITY</b>	Modern Iranian city or other locality (as of 2011)	The best assessment of the corresponding modern city or other locality as derived from multiple internet gazetteer resources.
<b>LATITUDE</b>	Location latitude (decimal)	The latitude coordinate of the interpreted province/locality pairs.
<b>LONGITUDE</b>	Location longitude (decimal)	The longitude coordinate of the interpreted province/locality pairs.
<b>LOCATION_REMARKS</b>	Notes regarding the location	Clarifying remarks in cases of ambiguous locations, location name changes, alternate spellings, or other updates to the interpreted province and locality

## 3. Experiment Table

The measured and observed characteristics entered in the database are identified here.

Field Name	Description	Comment
<b>EXP</b>	Experiment number	Each field planting was given a 5-digit experiment number (last two digits of the harvest year followed by an arbitrary three-digit number, (e.g., 91052).
<b>PLOT</b>	Sequential numbers of plots or rows within an experiment	A plot is the physical location for each entry, typically a single-row 2.5-m long, with 0.6 m between rows.
<b>SOURCE</b>	Origin of seed used for the field planting	Typically experiment number and plot number of the plant(s) that provided the seed used to plant the current plot.
<b>PLANT_DATE</b>	Date experiment was planted	

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<b>UCD_IWA_NO</b>	UC Davis identification number, 86xxxx	At UC Davis, each accession was given a unique Iranian Wheat Accession (IWA) seven-digit Identification number including the two-digit prefix 86. In addition, each check variety was assigned a number in the 869xxxx range. These numbers are the primary identifier for each accession and check variety throughout the database.
<b>SPECIES</b>	Accessions were classified as common (C), durum (D), mixed (M), or check (CK)	Based on observations in field plantings as a check on the species designation in accession table
<b>GROWTH_HABIT</b>	Growth habit (1=spring, 2=winter, 3=facultative)	Assessed for accessions sent to USDA National Small Grains Collection, Aberdeen ID, in a summer planting by USDA. Accessions that failed to head were designated winter (1); those that headed early: spring (2); and those that headed late: facultative (3).
<b>HEADING</b>	Heading date (days past March 31)	The number of days past March 31 when 50% of spikes had emerged from the flag leaf sheath
<b>MATURITY</b>	Maturity date (days past March 31)	The number of days past March 31 when 50% of the peduncles had turned yellow.
<b>GRAIN_FILL</b>	<b>MATURITY</b> minus <b>HEADING</b> (days)	Grain fill period is estimated by calculating the number of days from heading to maturity, <b>HD_DT</b> minus <b>MAT</b> .
<b>FLAGLF_LENGTH</b>	Flag leaf blade length (mm)	The length of the flag leaf blade determined after heading time, measured from the auricle to the tip of the leaf. Measurements were generally taken from two leaves per plot.
<b>FLAGLF_WIDTH</b>	Flag leaf blade width (mm)	The maximum width of same leaf as measured for length. Measurements were generally taken from two leaves per plot.
<b>HEIGHT</b>	Height (cm)	Measured at maturity from soil level to middle of spike
<b>SPIKE_LENGTH</b>	Spike length (mm)	Measured on two random spikes per accession from the collar to the tip of the apical spikelet
<b>AWN_LENGTH</b>	Awn length (mm)	Length of lemma awn measured on a spikelet from central portion of spike
<b>SPIKELETS_SPIKE</b>	Number of spikelets per spike	Two spikes per accession were used to count the number of spikelets per spike.
<b>SEED_WEIGHT</b>	Seed weight (g)	Weight of a sample of 50 kernels taken from the bulk of seed harvested from an accession.
<b>GLUME_PUB</b>	Glume pubescence (1 = glabrous, 2 = light, 3 = heavy)	Presence or absence of glume hairs scored on harvested spikes
<b>GLUME_COLOR</b>	Glume color (1 = white, 2 = bronze (brown), 3 = black)	Visually scored on harvested spikes
<b>AWN_COLOR</b>	Awn color (1 = awnless, 2 = white, 3 = bronze, 4 = black)	Visually scored on harvested spikes
<b>SEED_COLOR</b>	Seed color (1 = white, 2 = yellow (amber), 3 = brown (red), 4 = red (dark red))	Visually scored on a bulk sample of harvested seed
<b>GLAL_GLL</b>	Ratio of glume awn length to glume length	Visual estimate, not measured: 0.1 to 1.0 by tenths

<b>LEAF_RUST</b>	Leaf rust (0 to 100% leaf infection)	Visual estimates of leaf coverage after natural infection by leaf rust, scored as percentages using Cobb scale pustule coverage estimates. LEAF_RUST1, LEAF_RUST, or LEAF_RUST3 represent first, second, or third scoring in a season.
<b>YELLOW_RUST</b>	Yellow (stripe) rust (0 to 100% leaf infection)	Visual estimates of leaf coverage after natural infection by yellow rust, scored as percentages using Cobb scale pustule coverage estimates. YELLOW_RUST1, YELLOW_RUST2, or YELLOW_RUST3 represent first, second, or third scoring in a season.
<b>BYD</b>	Barley yellow dwarf virus disease symptoms (0 = no symptoms, 1 to 5 = increasing degree of yellowing, 6 to 8 = increased extent of yellowing, reduced tillering, and dwarfing, 9 = severe dwarfing or dead plants)	Visual estimation of BYD symptom expression taken pre- and post-heading.

#### 4. Checks Table

<b>Field Name</b>	<b>Short Description</b>	<b>Long Description</b>
<b>UCD_IWA_NO</b>	UC Davis identification number, 86xxxxx	At UC Davis, each accession was given a unique seven-digit identification number including the two-digit prefix 86. In addition, each check variety was assigned a number in the 869xxxx range. These numbers are the primary identifier for each accession and check variety throughout the database.
<b>SPECIES</b>	Latin binomial	<i>Triticum aestivum</i> , <i>T. turgidum</i> , and <i>Hordeum vulgare</i> are the species from which check varieties were selected.
<b>VARIETY</b>	Cultivar name	Ten different cultivars were used in the seven experiments.

## 5. Field\_info Table

Field Name	Short Description	Long Description
<b>EXP</b>	Experiment number	Each field planting was given a 5-digit experiment number (last two digits of the harvest year followed by an arbitrary three-digit number, (e.g., 91052: experiment 052, planted in 1990 and harvested in 1991).
<b>FIELD</b>	Agronomy Research Farm field identification number	This is the permanent identity of the location of the experiments planted at the Agronomy Farm, UC Davis
<b>ROW</b>	X-coordinate of a plot in grid overlay of an experiment	Each field plot can be assigned a row and column identification for exact spatial location; used for detecting gradients or other features of the field site.
<b>COLUMN</b>	Y-coordinate of a plot in grid overlay of an experiment	See above
<b>PLOT_NUM</b>	Sequential numbers of plots or rows within an experiment	A plot is the physical location for each entry, typically a single-row 2.5-m long, with 0.6 m between rows. Plot numbers were assigned in serpentine fashion for ease of note-taking and harvest.

### Calculated Traits

Several traits of interest can be calculated from the data of the experiment table.

Trait	Formula
Flag leaf area (cm <sup>2</sup> )	<b>FLAGLF_WIDTH * FLAGLF_LENGTH * 0.75</b>
Awn length to spike length ratio	<b>AWN_LENGTH / SPIKE_LENGTH</b>
Spike density (mm-internode <sup>-1</sup> )	<b>SPIKE_LENGTH / SPIKELETS_SPIKE</b>
Kernel weight (mg-kernel <sup>-1</sup> )	<b>SEED_WEIGHT / Number of seeds weighed</b>

**Matrix of Experiments by Percentage of Entries for which Data were Collected.**

Experiment	Total No. Plots	Characters and traits measured in the observation experiments																									
		GROWTH_HABIT	HEADING	MATURITY	GRAIN_FILL	FLAGF_LENGTH	FLAGF_WIDTH	HEIGHT	SPIKE_LENGTH	AWN_LENGTH	SPIKELETS_SPIKE	SEED_WEIGHT	GLUME_PUB	GLUME_COLOR	AWN_COLOR	SEED_COLOR	GLAL_GLL	LEAF_RUST	LEAF_RUST1	LEAF_RUST2	LEAF_RUST3	YELLOW_RUST1	YELLOW_RUST2	YELLOW_RUST3	BYD		
90052	2340	0	0	100	0	100	100	100	100	100	100	99	100	100	100	100	99	0	0	0	0	60	59	60	60	60	60
91052	2950	0	100	100	100	100	100	100	100	100	99	100	100	100	100	99	99	0	0	0	0	100	100	100	0	100	100
92052	3000	95	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100	0	0	0	4	0	0	0	0	100
93052	2255	95	100	100	100	100	100	100	100	100	99	100	100	100	100	99	99	0	100	100	100	100	100	100	100	100	100
94052	5184	0	100	92	92	92	16	16	16	16	90	16	16	16	16	16	16	66	0	0	0	0	100	92	0	100	100
95052	447	93	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	100
96052	904	0	100	100	100	100	100	100	100	100	93	100	100	100	100	93	100	0	100	100	0	100	0	0	0	0	0
96078	429	0	100	100	100	100	100	100	100	100	93	100	100	100	100	93	99	0	100	100	0	100	0	0	0	0	0