



Wheat landraces currently grown in Turkey: area, diversity and agronomic traits

A. Morgounov (CIMMYT), M. Kan (Turkey), M. Keser (ICARDA), M. Kucukongar (Turkey), H. Muminjanov (FAO), F. Ozdemir (Turkey), C. Qualset (UC Davis)



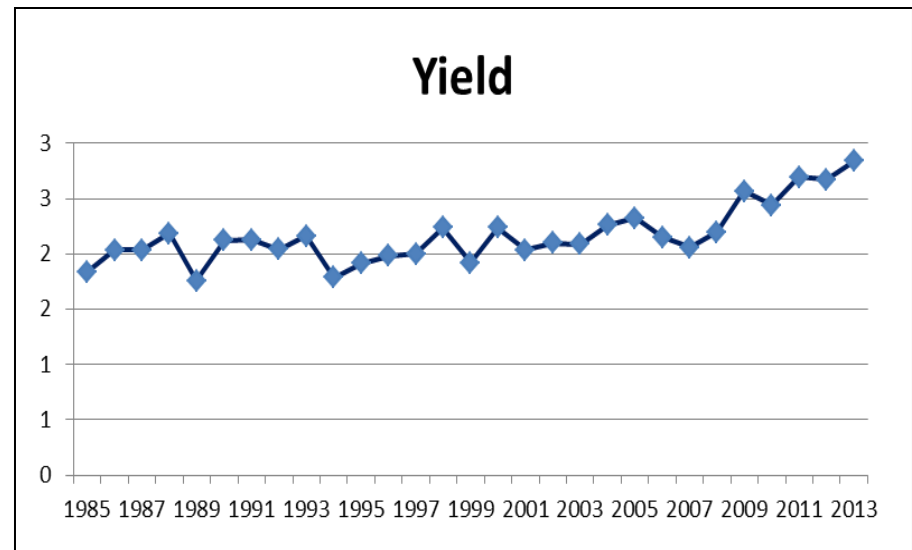
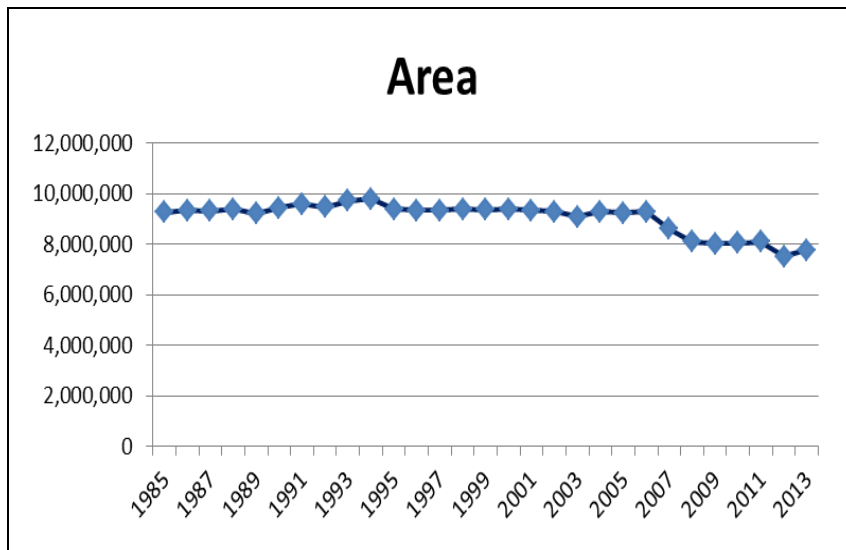
International Winter Wheat Improvement Program

- Established in 1986 and based in Turkey
- Development of winter wheat germplasm for Central and West Asia
- Facilitate global winter wheat germplasm exchange
- Product: Facultative and Winter Wheat Observation Nursery – FAWWON
- 60 varieties originating from IWWIP released and cultivated on area over 2 mln ha

Turkey wheat production: 1985-2013



More than 200 commercial varieties released and occupy the majority of wheat area in the country



Source: FAOSTAT

Wheat found in archeological sites in Turkey

Approximate dates (BC)	Sites	Plants
7500	Asikli Höyük	Domesticated emmer, durum wheat, barley, lentil, bitter vetch, pea, chick pea
7200-6500	Cayönü	Wild einkorn, emmer and barley; domesticated einkorn, emmer, pea, lentil, vetch and flax
6750	Hacilar	Wild einkorn; domesticated emmer
6000-5000	Catal Höyük	Domesticated einkorn, emmer, wheat, barley (naked), pea, vetch
6000-5000	Erbaba	Domesticated einkorn, emmer, wheat, barley (2 rowed and naked), pea, lentil, vetch



Harlan, 1992; van Zeist and de Roller, 1995; Karagöz et al., 2010

Wheat landraces collections in Turkey,,



Zhukovskiy: 1920s



Gokgol: 1930s



Harlan: 1940s, 60s

Major *in-situ* Turkish wheat collections

- Total 14,845
 - USA: 3900 accessions
 - Turkey: 3500 accessions
 - ICARDA: 3050 accessions
 - CIMMYT: 2025 accessions
 - Germany: 925 accessions
 - Vavilov Institute: 900 accessions

Source: <http://genesys-pgr.org/>



IWWIP wheat landrace activities

- Inventory of wheat landraces across the country.
 - Evaluate the status of wheat landraces in Turkey
 - Map the present cultivation areas
 - Representatively collect them
 - Study the landraces
 - Improve and return to farmers
 - Utilize for improvement of modern germplasm
 - Conservation
 - Transfer to Turkey National Gene Bank



Wheat landraces collections

Year	Number of provinces	Number of collections*
2009	3	134
2010	9	192
2011	6	43
2012	33	772
2013	9	159
2014	4	75
Total	62	1375

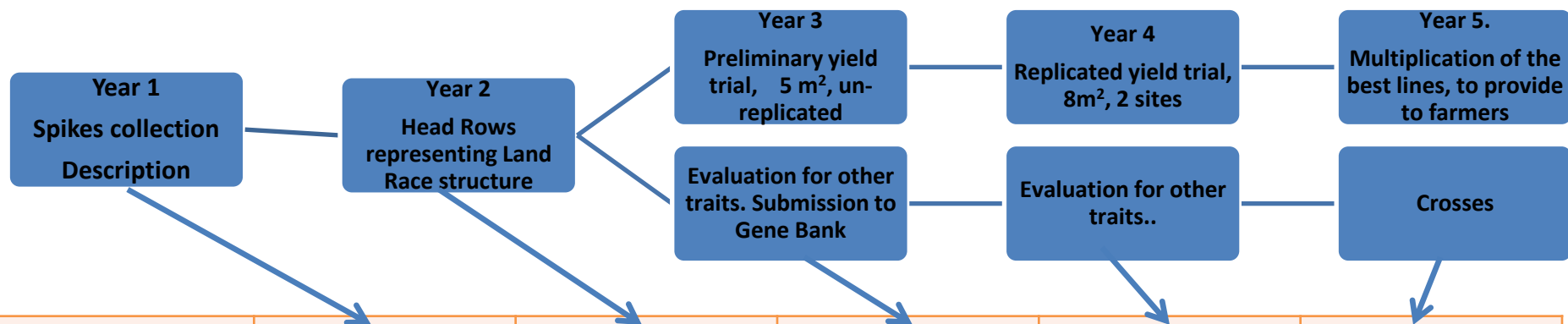


* Collection of at least 100 spikes representing the landrace.

- Communication to provinces and counties agriculture agencies to find out the possibility of landraces being grown
- Confirmation through the phone calls
- Identification of the villages with the landraces
- Communication to the village seniors and setting up appointments
- Visit-survey-collection



Wheat landrace movement through evaluation process



Collection year	Landraces collected	Headrows planted	PYT lines evaluated	Yield Trial lines evaluated	Lines multiplied
2009	134	2638	630	490	150
2010	258	3252	670	200	100
2011	143	1833	511	200	100
2012	773	12075	2343	600	-
2013	165	2500	300	-	-



Landrace diversity description approach

- Based on botanical description as described by N. Vavilov
- Assumption: highly inherited conservative traits preserve identity without artificial crosses
- Wheat species
- Within species – botanical varieties based on 5 highly heritable traits
 - Presence and type of awns
 - Color of awns
 - Spike glume color
 - Grain Color
 - Presence of glume pubescence

Botanical variety	Awns	Glume pubescence	Glume color	Grain color
Albidum	No	No	White	White
Lutescens	No	No	White	Red
Alborubrum	No	No	Red	White
Milturum	No	No	Red	Red
Leucospermum	No	Yes	White	White
Velutinum	No	Yes	White	Red
Delfi	No	Yes	Red	White
Pyrotrix	No	Yes	Red	Red
Greacum	Yes	No	White	White
Erythrospermum	Yes	No	White	Red
Erythroleucon	Yes	No	Red	White
Ferrugineum	Yes	No	Red	Red
Meridionale	Yes	Yes	White	White
Hostianum	Yes	Yes	White	Red
Turcicum	Yes	Yes	Red	White
Barbarossa	Yes	Yes	Red	Red

Source: N. Vavilov (1923). Bread wheat classification.



Botanical varieties of wheat landrace in Turkey

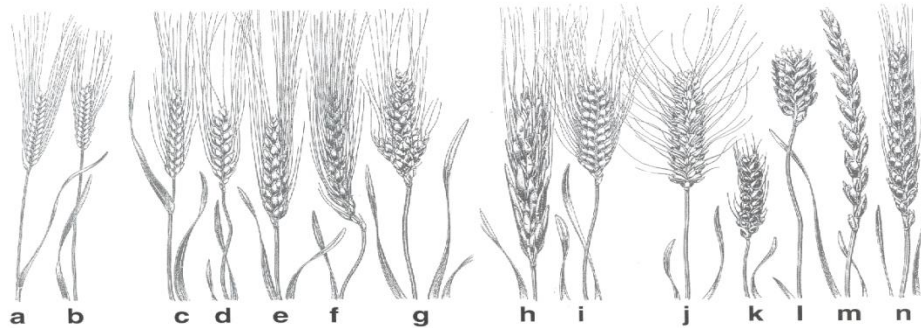
Tr. turgidum sp. durum
(DW)
 murciense
 pseudoalexandrinum
 aegyptiacum
 niloticum
 hordeiforme
 erythromelan
 italicum
 apulicum
 affine
 reichenbachii
 durum
 africanum
 leucurum
 leucomelan
 valenciae
 melanopus
 + 9 more botanical
 varieties

Tr. turgidum, sp. turgidum: 6 botanical varieties

Tr. dicoccum: 2 botanical varieties

Tr. monococcum: 2 botanical varieties

Tr. polonicum: 1 botanical variety



a, *Tritium boeotium* (2x: wild einkorn); **b**, *T monocoeum* (2x: einkorn); **c**, *T dicoccoides* (4x: wild emmer); **d**, *T. dicoceum* (4x: emmer); **e**, *T durum* (4x: macaroni wheat); **f**, *T. carthlicum* (4x: Persian wheat); **g**, *T. turgidum* (4x: rivet wheat); **h**, *T polonieuum* (4x: Polish wheat); **i**, *T. timopheevii* (4x: Timopheev's wheat); **j**, *T aestivum* (6x: bread wheat); **k**, *T. sphaerocoeum* (6x: shot wheat, Indian dwarf wheat); **l**, *T compactum* (6x: club wheat); **m**, *T spelta* (6x: spelt wheat); and **n**, *T macha* (6x: macha wheat).



Botanical varieties of wheat landrace in Turkey

Tr. aestivum sp. aestivum (BW)

sub-ferrugineum
 ferrugineum
 pseudo-ferrugineum
 barbarossa
 pseudo-barbarossa
 erythroleucum
 pseudo-erythroleucum
 turcicum
 pseudo-turcicum
 sub-erythrosperrum
 erythrosperrum
 pseudo-erythrosperrum
 hostianum
 pseudo-hostianum
 greacum
 pseudo-greacum
 meridionale
 pseudo-meridionale
 milturum
 pyrotrix
 albirubrum
 pseudoturanicum
 delfii
 pseudodelfii
 lutescens
 velutinum
 albidum
 leucospermum

Tr. aestivum sp. aestivum ssp. compactoides (BW-BC)

ferrugineum-compactoides
 pseudo-ferrugineum-compactoides
 barbarossa-compactoides
 pseudo-barbarossa-compactoides
 erythroleucum-compactoides
 pseudo-erythroleucum-compactoides
 turcicum-compactoides
 pseudo-turcicum-compactoides
 erythrosperrum-compactoides
 pseudo-erythrosperrum-compactoides
 hostianum-compactoides
 pseudo-hostianum-compactoides
 greacum-compactoides
 pseudo-greacum-compactoides
 meridionale-compactoides
 pseudo-meridionale-compactoides

Tr. aestivum sp. compactum (BW-C)

erinaceum
 echinoideum
 kerkianum
 fetissoyii
 rubriceps
 icterinum
 albiceps
 kanaschii
 compactum
 pseudosplendens
 sericeum
 creticum
 rufulum
 wernerianum
 humboldtii
 linaza

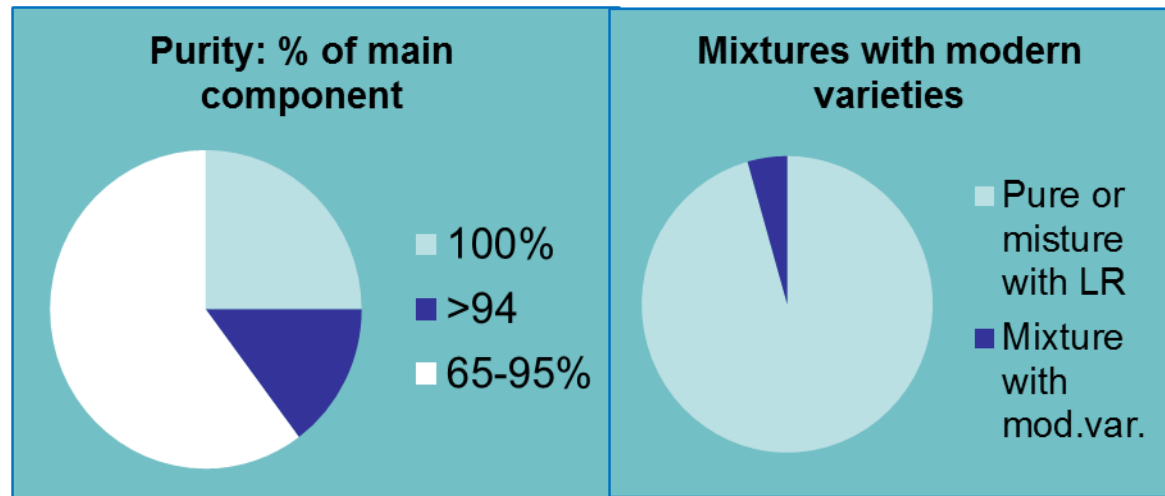
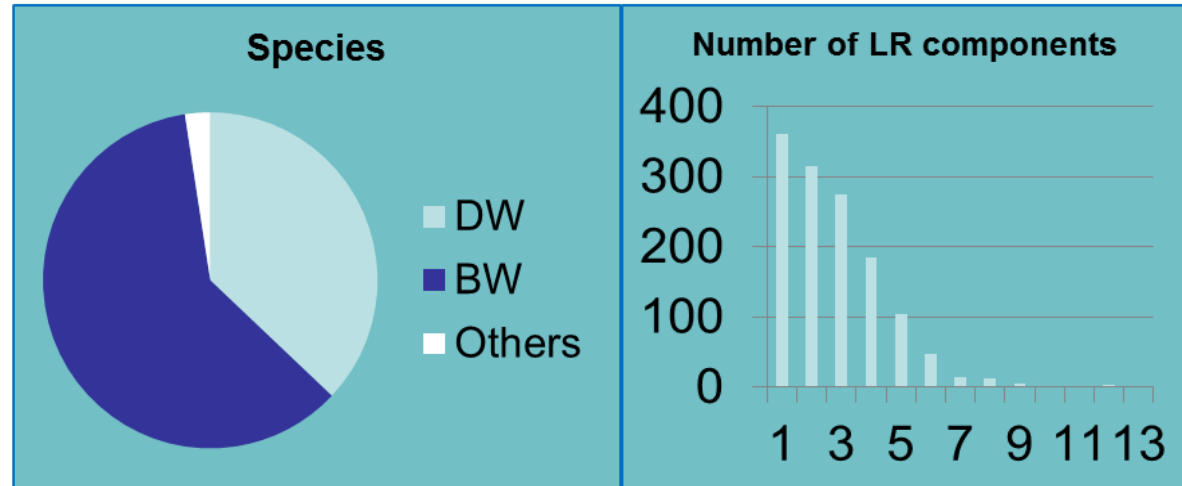


Botanical varieties of wheat landrace in Turkey

Species	Number of botanical varieties	
	2010s	1930s
<i>Tr. monococcum</i>	2	4
<i>Tr. dicoccum</i>	2	2
<i>Tr. turgidum, sp. turgidum</i>	6	49
<i>Tr. turgidum sp. durum</i>	23	82
<i>Tr. polonicum</i>	1	12
<i>Tr. percicum</i>	2	0
<i>Tr. aestivum sp. aestivum</i>	45	159
<i>Tr. aestivum sp. compactum</i>	16	80
Total	95	388

Diversity of wheat landraces currently cultivated in Turkey

- Based on botanical description and composition of individual landraces
- Species:
 - Durum Wheat (DW)
 - Bread Wheat (BW)
 - Bread Wheat – Club Wheat (BC)
 - Club Wheat (CW)
- Pure vs. mixture of individual landrace
 - 100% the same BV
 - $\geq 95\%$
 - $\geq 65\%$ of the major LR component
 - Number of components within individual LR
- Mixtures with modern varieties



Wheat landraces of Aegean region

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Afyon		1					1
Denizli	1						1
Izmir	2						2
Kutahya	2	1	1		1		5
Manisa	2	4	2	1	1	2	12
Mugla		1	1	1		1	4
Uşak		1	1	1		1	4
Total	7	8	5	3	2	4	29
Total, %	24.1	27.6	17.2	10.3	6.9	13.7	100



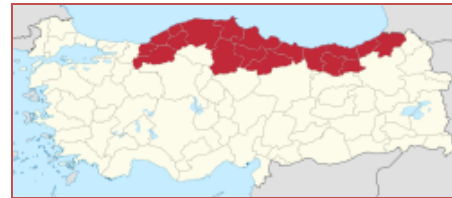
Average altitude: 772 masl
Average number of landrace components: 3.9



Farmers description	
Average farm size, ha	5.8
Average farmer age	55.3
Number of people per household	4.6
% of farmers graduating primary school only or none	92.3
% of wheat planted by hand	52.0
% of farmers growing both MV and landraces	27.0
% of farmers who never change the seed	51.8
% of farmers using wheat for bread	53.9
% of farmers satisfied with grain yield	84.5
% of farmers satisfied with grain quality	87.3

Wheat landraces of Black Sea region

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Amasya	2						2
Artvin		2				2	4
Bartın	2	2				2	6
Bayburt		3				2	5
Bolu	1				1	1	3
Düzce		1					1
Giresun	1	3	2			2	8
Gümüşhane		3				1	4
Karabük		1			2		3
Kastamonu		1			1	1	3
Ordu		2				1	3
Samsun	1				2		3
Sinop	2	1			2	1	5
Tokat	2	4	1				7
Total	11	23	3	0	8	13	57
Total, %	19.2	40.3	5.2	0	14.0	22.8	100



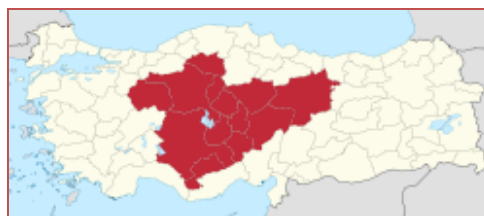
Average altitude: 1073 masl
Average number of landrace components: 2.8

Farmers description	
Average farm size, ha	6.1
Average farmer age	55.7
Number of people per household	4.3
% of farmers graduating primary school only or none	76.9
% of wheat planted by hand	86.0
% of farmers growing both MV and landraces	40.0
% of farmers who never change the seed	84.9
% of farmers using wheat for bread	51.5
% of farmers satisfied with grain yield	81.0
% of farmers satisfied with grain quality	94.0



Wheat landraces of Central Anatolia

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Aksaray	1	3		1		2	7
Eskisehir		2				1	3
Karaman	2	2		1		3	8
Kayseri		1					1
Kirikkale		2					2
Kirsehir	1						1
Konya	1	3	1	1		2	8
Nevsehir	1	1					2
Nigde		2				2	4
Sivas		1					1
Yozgat	2	1				3	6
Total	8	18	1	3	0	13	43
Total, %	18.6	41.8	2.3	7.0	0	30.2	100



Average altitude: 1292 masl
Average number of landrace components: 3.0

Farmers description	
Average farm size, ha	11.1
Average farmer age	53.7
Number of people per household	5.4
% of farmers graduating primary school only or none	95.7
% of wheat planted by hand	27.0
% of farmers growing both MV and landraces	26.8
% of farmers who never change the seed	51.0
% of farmers using wheat for bread	59.9
% of farmers satisfied with grain yield	68.3
% of farmers satisfied with grain quality	96.3



Wheat landraces of East Anatolia

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Agri		4		1		4	8
Bingol		1	1				2
Bitlis		3	1			1	5
Elazig	1	1	1		1		4
Erzurum		5	1	1			7
Igdir	1	5	2				8
Malatya	2	3	1		1	1	8
Van						1	1
Total	4	21	7	2	2	7	43
Total, %	9.3	48.8	16.3	4.6	4.6	16.3	100



Average altitude: 1292 masl
Average number of landrace components: 2.4

Farmers description	
Average farm size, ha	8.0
Average farmer age	52.7
Number of people per household	6.9
% of farmers graduating primary school only or none	90.5
% of wheat planted by hand	60.0
% of farmers growing both MV and landraces	8.8
% of farmers who never change the seed	42.8
% of farmers using wheat for bread	70.3
% of farmers satisfied with grain yield	81.0
% of farmers satisfied with grain quality	99.0



Wheat landraces of Marmara region

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
	Balikesir		2				
Bilecik	1					1	2
Bursa		2					2
Canakkale	1	1					2
Total	2	5				1	8
Total, %	25.0	62.5	0	0	0	12.5	100

Average altitude: 683 masl
Average number of landrace components: 4.0



Farmers description	
Average farm size, ha	7.2
Average farmer age	55.9
Number of people per household	3.9
% of farmers graduating primary school only or none	96.0
% of wheat planted by hand	70.0
% of farmers growing both MV and landraces	45.5
% of farmers who never change the seed	52.0
% of farmers using wheat for bread	81.5
% of farmers satisfied with grain yield	62.0
% of farmers satisfied with grain quality	94.0

Wheat landraces of Mediterranean region

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Adana	2	2	1			1	6
Antalya	2	1					3
Burdur	1	1	1			1	4
Hatay	2	2	1	1			6
Isparta	2						2
K. Maras	1	3	1				4
Mersin	2	1				2	5
Osmaniye	2	1				2	5
Total	14	10	4	1	0	6	35
Total, %	40.0	28.6	11.4	2.8	0	17.2	100



Average altitude: 886 masl
Average number of landrace components: 2.7



Farmers description	
Average farm size, ha	5.3
Average farmer age	54.8
Number of people per household	4.6
% of farmers graduating primary school only or none	89.2
% of wheat planted by hand	62.0
% of farmers growing both MV and landraces	21.8
% of farmers who never change the seed	60.9
% of farmers using wheat for bread	42.1
% of farmers satisfied with grain yield	93.1
% of farmers satisfied with grain quality	96.4

Wheat landraces of South-East Anatolia

Province	DW	BW	BW-BC	BW-C	T.m/T.d/T.t	Mixture	Total
Adiyaman	2	2	1		1	5	11
Batman	1						1
Diyarbakir	2	2	1	1		3	9
Gaziantep	2	1					3
Kilis	1	1	1				3
Mardin	2	1	1			2	6
Sanliurfa	2						2
Siirt	2	3	1			2	8
Sirnak	1	1					2
Total	13	9	4	1	1	7	34
Total, %	38.2	26.6	11.8	2.9	2.9	20.6	100



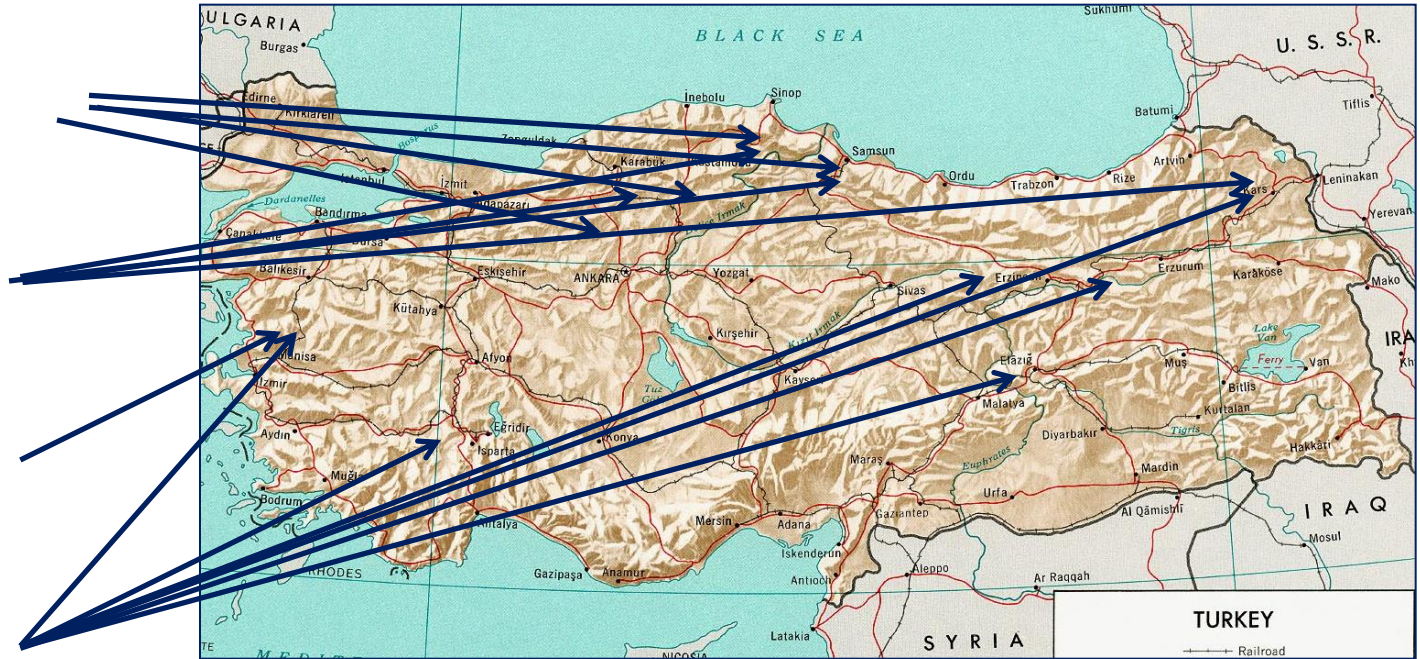
Average altitude: 852 masl
Average number of landrace components: 2.4



Farmers description	
Average farm size, ha	6.9
Average farmer age	51.6
Number of people per household	7.0
% of farmers graduating primary school only or none	95.7
% of wheat planted by hand	53.0
% of farmers growing both MV and landraces	26.3
% of farmers who never change the seed	12.3
% of farmers using wheat for bread	48.6
% of farmers satisfied with grain yield	79.0
% of farmers satisfied with grain quality	100.0

Rare wheat landraces

- *Tr. monococcum*
- *Tr. dicoccum*
- *Tr. polonicum*
- *Tr. Turgidum sp. turgidum*



Wheat landraces of Turkey: summary

- Wheat landraces in Turkey are grown all over the country primarily by small family farms in mountainous remote villages using traditional technologies
- Majority of the farmers had access to MV and 30% grow both but maintain the landraces because of tradition, adaptation and suitability for home consumption
- Highest diversity of the landraces in the Black Sea region, Central and East Anatolia
- Durum wheat dominates in the South and S. East

Region	Number of landraces	DW	BW	BW-BC	BW-C	T.m/T.d /T.t	Mixture
Aegean	29	24.1	27.6	17.2	10.3	6.9	13.7
Black Sea	57	19.2	40.3	5.2	0	14.0	22.8
Central Anatolia	43	18.6	41.8	2.3	7.0	0	30.2
East Anatolia	43	9.3	48.8	16.3	4.6	4.6	16.3
Marmara	8	25.0	62.5	0	0	0	12.5
Mediterranean	35	40.0	28.6	11.4	2.8	0	17.2
South East Anatolia	34	38.2	26.6	11.8	2.9	2.9	20.6
Total	249	23.7	37.8	9.6	4.0	5.2	20.5



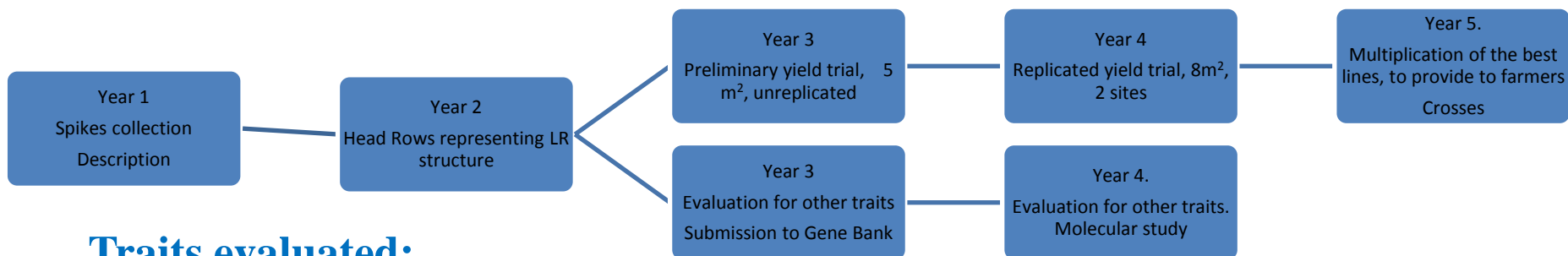
Wheat landraces changes from 1930

Landrace	2012 %	2012 Region	1930 %	1930 Region
Ak Bugday	7.0	Central and East Anatolia, Aegean, Mediterranean	3.2	All
Asurelik Bugday	1.9	East Anatolia	0.07	East Anatolia
Goderedi	1.8	Central Anatolia	0	
Kamci	2.2	Central Anatolia	0.001	Central Anatolia
Karakilcik	4.9	East and South-East Anatolia, Med.	8.2	All
Kirik	4.2	East Anatolia, Black Sea	1.6	East Anatolia, Black Sea
Kirmizi Bugday	2.2	All	1.5	All
Koca Bugday	4.8	Aegean, Central Anatolia, Medi-ean	1.0	All
Sari Bugday	7.0	Marmara, Central Anatolia, Black Sea, Mediterranean	1.9	All
Topbas	2.7	Black Sea, Eastern Anatolia	2.2	B. Sea, C. & E. Anatolia
Zerun	3.2	Central and East Anatolia	1.0	Central and East Anatolia
Total	41.9		20.6	

Wheat landraces changes from 1930

Landrace	2012			1930		
	DW	BW	CW	DW	BW	CW
Ak Bugday	22.7	54.9	20.7	42.0	43.5	14.5
Asurelik Bugday	0.7	93.2	0.4	3.0	94.9	2.1
Goderedi	3.4	82.6	0.5	-	-	-
Kamci	0.9	81.8	6.6	-	-	-
Karakilcik	62.9	29.1	6.9	66.0	28.1	5.9
Kirik	0	98.5	1.1	3.6	87.7	8.7
Kirmizi Bugday	16.8	65.7	16.7	45.6	47.7	6.8
Koca Bugday	50.7	37.5	9.3	92.9	5.1	2.0
Sari Bugday	61.0	15.5	20.7	81.9	11.4	6.7
Topbas	5.3	37.9	55.5	0.6	33.1	66.3
Zerun	0.9	97.9	0.1	0.2	96.4	3.4
Total	22.0	58.9	14.6	37.3	49.8	12.9

Wheat landrace evaluation system



Traits evaluated:

Yield

Grain quality

1000 kernel weight Mol. markers

Test weight

Glu composition

Leaf rust: seedling & APR

Yellow rust: seedling & APR

Stem rust: APR

Cereal Cyst Nematode

Crown rot

Growth habit



Wheat landraces: agronomic performance

1000 kernel weight

12ENTRY	LANDRACE	PROVINCE	Village	ALTITUDE	FARMER NAME	TYPE	1000kw
59	GEREK						34.9
426	KOCA BUGDAY	KONYA	TARLABASI	1549	NEVZAT DEMIROZ	BW	47.1
434	KOCA BUGDAY	KONYA	KAYAPINAR	1498	AYSE KOCAK	BW	47.0
286	SARI BUGDAY	KARAMAN	CATALBADEM	1080	MUSTAFA DOGAN	DW	47.0
351	SARI BUGDAY	KONYA	GOYNUKISLA	1163	YAKUP CENGIZ	BW	46.8
328	SARI BUGDAY	KONYA	SELAHATTIN	1164	ALI OZTAS	BW	46.5
429	KOCA BUGDAY	KONYA	KAYAPINAR	1498	HASAN ALTUN	DW	46.3

Coleoptile length

12ENTRY	LANDRACE	PROVINCE	Village	ALTITUDE	FARMER NAME	TYPE	Col. length
340	GEREK						4.96
235	GODEREDI	KARAMAN	CIVANDERE	1414	HASAN KAFES	BW	7.74
262	GODEREDI	KONYA	BALCILAR	1655	BAYRAM KANDEMIR	BW	7.52
233	GODEREDI	KARAMAN	ADILLER	1413	MUSTAFA TASPINAR	BW	7.46
243	GODEREDI	KARAMAN	CIVLER	1410	MEHMET YAMAN	BW	7.44
459	KUNDURU	KONYA	HISARLIK	1475	HASAN HUSEYIN SUCU	BW	7.30
283	SARI BUGDAY	KARAMAN	YALINDAL	887	NEBI GURBUZ	CW	7.23

Yellow Rust

12ENTRY	LANDRACE	PROVINCE	Village	ALTITUDE	FARMER NAME	TYPE	Seedling YR	Field YR
300	GEREK						7	100S
211	AKBUGDAY	KARAMAN	CIVLE	1410	ISMET OFLAZ	BW	0	0
484	TOPBAS	ERZURUM	ALATARLA	1545	AHMET UCAR	BW	0	0
28	TOPBAS	ERZURUM	BALLICA	1560	MEHMET POLAT	BW	0	0
36	TOPBAS	ERZURUM	CAMLIBEL	1748	RECEP SARIKAYA	BW	0	0
115	KIRIK	ERZURUM	DEMIRDOGEN	1730	NECMETTIN KIRTEPE	BW	6-7	0
110	KIRIK	ERZURUM	YUKARI CAKMAK	1731	NADIM SARAC	BW	8	0
136	KIRIK	ERZURUM	PORSUK	1789	HUSNU ERKMEN	BW	8	0
255	GODEREDI	KARAMAN	CUKURBAG	1446	UMMU AKKOL	BW	7	0

Yield

12ENTRY	LANDRACE	PROVINCE	Village	ALTITUDE	FARMER NAME	TYPE	Yield kg/ha
348	KARAHAN						1673
300	GEREK						2120
181	YORUK BUGDAYI	KARAMAN	ADILLER	1413	MUSTAFA TASPINAR	BW	2946
105	KIRIK	ERZURUM	CICEKLI	1879	HANIFI AYDIN	BW	2866
325	SARI BUGDAY	KONYA	SOGUT	1514	OSMAN OGUT	CW	2838
304	SARI BUGDAY	KARAMAN	YAYLAPAZARI	900	HASAN ACAR	CW	2484
187	AKBUGDAY	KARAMAN	ADILLER	1413	CEMAL URESIN	BW	2380
161	DIGE BUGDAYI	ERZURUM	DEREBASI	1580	YUSUF ALBAYRAK	BW	2334
103	KIRIK	ERZURUM	CICEKLI	1879	LOKMAN BINGOL	BW	2170
13	TOPBAS	ERZURUM	INANMIS	1845	AHMET FIDAN	BW	2161
305	SARI BUGDAY	KARAMAN	YAYLAPAZARI	900	HASAN ACAR	CW	2155

Resistance of wheat landraces to Leaf Rust

Nursery	No	Landrace	Province	County	Village	Seedling	Adult Plant
12YT-LANDR	351	SARI BUGDAY	KONYA	HADIM	GOYNUKISLA	0	5MS
12YT-LANDR	351	SARI BUGDAY	KONYA	HADIM	GOYNUKISLA	0	5MS
12YT-LANDR	258	GODEREDI	KONYA	BOZKIR	KOVANLIK	0	5MR
12YT-LANDR	478	KUNDURU	KONYA	HADIM	BOLAT	0	100S
12YT-LANDR	30	TOPBAS	ERZURUM	OLTU	CAMLIBEL	1	10MR
12YT-LANDR	147	KIRIK	ERZURUM	PASINLER	TASKAYNAK	;	10MR
12YT-LANDR	12	TOPBAS	ERZURUM	OLTU	INANMIS	;	5MR
12YT-LANDR	255	GODEREDI	KARAMAN	SARIVELILER	CUKURBAG	;	5MR
12YT-LANDR	328	SARI BUGDAY	KONYA	HADIM	SELAHATTIN	;	5MR
12YT-LANDR	359	SARI BUGDAY	KONYA	HADIM	GOYNUKISLA	;	5MS
12YT-LANDR	183	AKBUGDAY	KARAMAN	ERMENEK	CATALBADEM	;	5MR
12YT-LANDR	186	AKBUGDAY	KARAMAN	SARIVELILER	ADILLER	;	10MS
12YT-LANDR	209	AKBUGDAY	KARAMAN	SARIVELILER	CIVLE	;	20MR
12YT-LANDR	328	SARI BUGDAY	KONYA	HADIM	SELAHATTIN	;	5MR
12YT-LANDR	359	SARI BUGDAY	KONYA	HADIM	GOYNUKISLA	;	5MS
12YT-LANDR	366	AKCABUGDAY	KONYA	BOZKIR	HISARLIK	;	100S
12YT-LANDR	434	KOCA BUGDAY	KONYA	BOZKIR	KAYAPINAR	;	10MS
12YT-LANDR	324	SARI BUGDAY	KONYA	BOZKIR	SOGUT	;	20MS
12YT-LANDR	259	GODEREDI	KONYA	BOZKIR	KOVANLIK	;	5MR
12YT-LANDR	477	KUNDURU	KONYA	HADIM	BOLAT	;	5MR
12YT-LANDR	441	KOCA BUGDAY	KONYA	BOZKIR	KAYAPINAR	;	5MR
12YT-LANDR	352	SARI BUGDAY	KONYA	HADIM	GOYNUKISLA	;	5MR
12YT-LANDR	411	KOCA BUGDAY	KONYA	BOZKIR	ELMAAGAC	;	5MR
12YT-LANDR	341	SARI BUGDAY	KONYA	HADIM	SELAHATTIN	;1	5MR
12YT-LANDR	19	TOPBAS	ERZURUM	OLTU	BASBAGLAR	1+	5MR

Nursery	No	Landrace	Province	County	Village	Seedling	Adult Plant
12YT-LANDR	419	KOCA BUGDAY	KONYA	BOZKIR	ELMAAGAC	3	TMR
12YT-LANDR	248	GODEREDI	KARAMAN	SARIVELILER	CUKURBAG	3	TMR
12YT-LANDR	339	SARI BUGDAY	KONYA	HADIM	SELAHATTIN	3	5MS
12YT-LANDR	144	KIRIK	ERZURUM	PASINLER	TASKAYNAK	3	5MR
12YT-LANDR	219	AKBUGDAY	KONYA	BOZKIR	SOGUCAK	3	5MR
12YT-LANDR	7	TOPBAS	ERZURUM	OLTU	GUZELSU	3	40MSS
12YT-LANDR	73	KIRIK	ERZURUM	OLTU	SULUNKAYA	3	20MS
12YT-LANDR	148	KIRIK	ERZURUM	PASINLER	TASKAYNAK	3	20MR

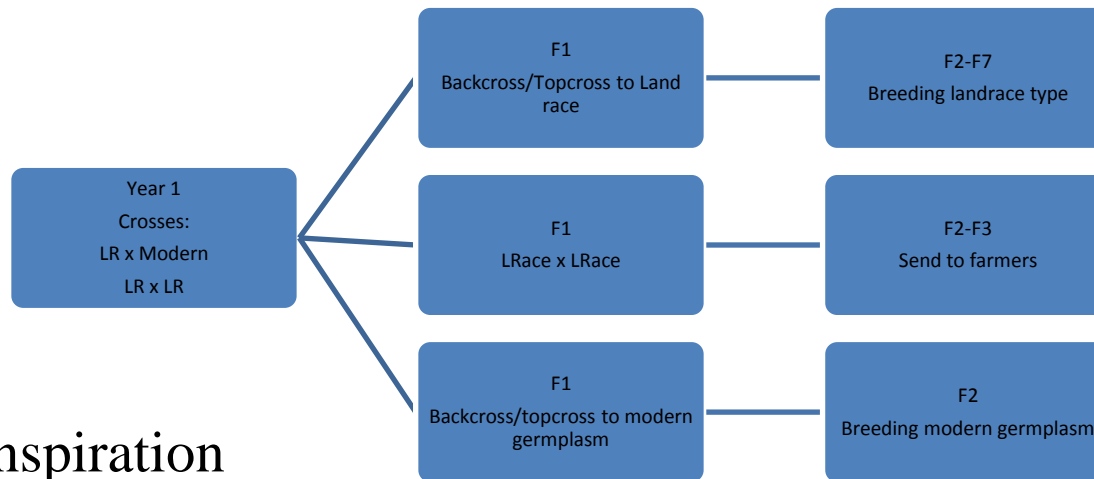
Wheat landraces resistant to Soil Borne Pathogens

- Landraces resistant to Dryland Crown Rot (*Fusarium culmorum*) and Wheat Lesion Nematode (*Pratylenchus thornei* and *P. Neglectus*)
- Selection of the landraces based on FIGS
- FIGS selection to be compared to the whole set of landraces



Nursery	Entry	Landrace	Region	Province	County	Village
14LRACE-PYT	19	Kabak buğdayı	AEG	Balıkesir	Dursunbey	Delice
14LRACE-PYT	35	Kabak buğdayı	AEG	Balıkesir	Dursunbey	Delice
14LRACE-PYT	22	KIRMIZI EVLEK	AEG	MANİSA	KULA	GÜVERCİNLİK
14LRACE-PYT	218	ÜVEYİK BUĞDAYI	BS	AMASYA	SULUOVA	BAYIRLI
14LRACE-PYT	208	KOTEL+TİCARİ BUĞDAY	BS	ARTVİN	ARDANUÇ	BOYALI
14LRACE-PYT	211	KOTEL+TİCARİ BUĞDAY	BS	ARTVİN	ARDANUÇ	BOYALI
14LRACE-PYT	213	DÖL BUĞDAYI	BS	ARTVİN	ARDANUÇ	SAKARYA
14LRACE-PYT	221	KOTEL+TİCARİ BUĞDAY	BS	ARTVİN	ARDANUÇ	BOYALI
14LRACE-PYT	245	KÖY BUĞDAYI	BS	ARTVİN	ŞAVŞAT	DALKIRMAZ
14LRACE-PYT	246	KÖY BUĞDAYI	BS	ARTVİN	ŞAVŞAT	DALKIRMAZ
14LRACE-PYT	276	DÖL BUĞDAYI	BS	ARTVİN	ARDANUÇ	SAKARYA
14LRACE-PYT	277	DÖL BUĞDAYI	BS	ARTVİN	ARDANUÇ	SAKARYA
14LRACE-PYT	278	KOTEL+TİCARİ BUĞDAY	BS	ARTVİN	ARDANUÇ	BOYALI
14LRACE-PYT	370	KOTEL+TİCARİ BUĞDAY	BS	ARTVİN	ARDANUÇ	BOYALI
14LRACE-PYT	1375	KÖY BUĞDAYI	BS	KARABÜK	EFLANİ	GÜNLÜCE
14LRACE-PYT-HAND	2350	KÖY BUĞDAYI	BS	KARABÜK	EFLANİ	GÜNLÜCE
14LRACE-PYT-HAND	2405	KIRMIZI BUĞDAY	BS	KARABÜK	EFLANİ	KARLI
14LRACE-PYT	313	KIRMIZI BUĞDAY	BS	KARABÜK	EFLANİ	KARLI
14LRACE-PYT	325	KÖY BUĞDAYI	BS	KARABÜK	EFLANİ	GÜNLÜCE
14LRACE-PYT	326	KÖY BUĞDAYI	BS	KARABÜK	EFLANİ	ÇEMÇİ
14LRACE-PYT	364	KÖY BUĞDAYI	BS	KARABÜK	EFLANİ	GÜNLÜCE
14LRACE-PYT	238	SARI (ÜVEYİK) BUĞDAY	BS	SAMSUN	LADİK	AĞCAKAYA
14LRACE-PYT	239	ÜVEYİK BUĞDAYI	BS	SAMSUN	LADİK	SARIGAZEL
14LRACE-PYT	230	SOFU BUĞDAYI	BS	TOKAT	MERKEZ	YELPE KÖYÜ
14LRACE-PYT	232	ÜVEYİK BUĞDAYI	BS	TOKAT	TURHAL	YEŞİLLAN
14LRACE-PYT	1236	GEVRE YUMUŞAK	SEA	ADİYAMAN	KAHTA	BAĞBAŞI
14LRACE-PYT-HAND	2668	GEVRE YUMUŞAK	SEA	ADİYAMAN	KAHTA	BAĞBAŞI
14LRACE-PYT	224	ARI BUĞDAY	BS	GÜMÜŞHANE	TORUL	DEMİRKAPI

Wheat landrace crossing program



Dr. Cal Qualset inspiration



14F1LRACE	10	KIRIK/4/ARLIN//TA2460/*3 TAM107/3/RINA-6
14F1LRACE	70	8600072-1//KS920709-B-5-1-1/DEMIR
14F1LRACE	78	KIRIK/4/ARLIN//TA2460/*3 TAM107/3/RINA-6
14F1LRACE	97	NO NAME/6/BATERA//KEA/TOW/3/TAM200/4/494J6.11//TRAP#1/BOW/5/TX96V2427
14F1LRACE	116	TOPBAS//KS920709-B-5-1-1/DEMIR
14F1LRACE	141	KIRIK/5/TAM200/KAUZ/3/SPN/NAC//ATTILA/4/F885K1.1/SXL/6/KS920709-B-5-1-1/DEMIR
14F1LRACE	164	KILCIKLI BUGDAY/BILINMIYEN96.7//KS920709-B-5-1-1/DEMIR

Conclusions and perspectives

- The landraces are still grown in Turkey: more than 200
 - Still 2-3 provinces to be surveyed/collected
- Unexpectedly huge diversity is maintained by the farmers normally in remote villages in the mountains
- Their main preference for growing is stable yield, quality for home products and tradition
- Important for climate effect on wheat production
 - Survival of the landraces till now indicates their fitness for CC
 - Variety mixture concept including LR may be again on agenda
- Superior landraces with useful agronomic traits identified
- Crossing program is underway to improve the landraces and modern varieties
- Future work
 - Continue agronomic evaluation and selection
 - Use genomic tools to classify the landraces and evaluate diversity
 - Association mapping of drought tolerance and other traits
 - Establishment of the core set and development of molecular markers for useful agronomic traits
 - Detailed study of the grain quality especially for non-bread products
 - Delivery of improved landraces back to farmers
 - Policy to support maintaining the LR

Acknowledgement

- Farming community of Turkey for preserving the landraces
- Numerous cooperators from Turkey research institutes and extension agencies who conducted the survey and collections
- FAO-SEC for supporting collection in Turkey in 2012 and 2013
- Vavilov Institute staff for assisting in botanical description

