

HULLED WHEAT FARMING IN DEVELI

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Abstract

Emmer (Triticum dicoccum) and einkorn (T. monococcum) cultivation has a long history in Anatolia. The crops, cultivated in Anatolia over thousands years, can still be found in some parts of the country, especially Develi in the Kayseri province. The total cultivation area of these crops was around 36 000 ha in 2015. The species is mainly cultivated in sloping and marginal lands by poor farmers, where no other crops can be economically grown. Cultivation area is rapidly declining, and if such trend continues, hulled wheats will be shortly completely wiped out from Turkey. Present-day distribution of emmer and spelt within Turkey is concentrated in countryside areas of Develi where traditional farming systems still survive. This group of wheats is called in Turkish the general name of 'kaplica' which means 'covered' or 'hulled'. More specifically, the tetraploid species (emmer) is called 'gacer' in the Develi. Being a low-yielding type of wheat, emmer was replaced by other improved varieties of Triticum. This decrease was mainly due to the widespread use of improved cultivars of wheat and the adoption of new agricultural techniques, but also to social and economic factors. In fact, wheat yielded 2840 t/ha, whereas hulled wheats yielded 1200 t/ha. The cultivation of these two crops shows disadvantages that relate to the harvesting techniques used and the need to dehisce the spikelets to obtain the grain for human consumption. The increasing interest in low-input systems due to the actual ecological and economical situation has led to a growing interest in specific genetic variability. Organic agriculture and health food products have been gaining increasing popularity that has led to a renewed interest in hulled wheat species such as emmer and spelt. The objective of this study was to estimate agronomical and grain quality characteristics of some Turkey (Develi) emmer landraces. This effort was motivated by the fact that autochthonous materials are at risk of being lost.

Keywords: Hulled wheat, Develi, Gacer

1. INTRODUCTION

Emmer (*Triticum dicoccum*) and einkorn (*T. monococcum*) cultivations have a long history in Anatolia. These crops can still be found in some parts of the country, especially Develi province of Kayseri. The total cultivation area of these crops was around 36 000 ha in 2015. The species is mainly cultivated in sloping and marginal lands by poor farmers, where no other crops can be economically grown. Cultivation area is rapidly declining. If such trend continues, hulled wheats will be shortly completely wiped out. Present-day distribution of emmer and spelt within Turkey is concentrated in countryside areas of Develi where traditional farming systems still survive. This group of wheats is called 'kaplica' which means 'covered' or 'hulled'. More specifically, the tetraploid species (emmer) is called 'Gacer' in the Develi. Emmer was replaced by other improved varieties of *Triticum*, due to its low yield. This decrease was mainly due to the widespread use of improved wheat cultivars. In fact, modern wheat cultivars have 2.840 t/ha seed yield, whereas hulled wheats yielded 1.200 t/ha. The cultivation of hulled wheats has some disadvantages such as

removing the spikelets to obtain the naked grains. The increasing interest in low-input systems due to the actual ecological and economical situation has led to a growing interest in specific genetic variability. Organic agriculture and healthy food products have been gaining popularity that has led to a renewed interest in hulled wheat species such as emmer and spelt (Hammer and Perinno, 1995; Marconi et al., 1999; Frégeau-Reid and Abdel-Aal, 2005). The objective of this study was to estimate agronomical and grain quality characteristics of some Turkish (Develi) emmer landraces.

2. MATERIALS AND METHODS

The origin of hulled wheat

The wheat crop has been cultivated for 10000 years (Marconi and Cubadda, 2005). Wheat was domesticated in the Near-East in 8000 B.C. The cultivated modern wheat varieties are tetraploid (AABB) and hexaploid (AABBDD) wheat species. *Triticum turgidum*, the ancestor of durum wheat, was developed by natural a cross of *Triticum monococcum* and *Aegilops speltoides* (Aktaş, 1994; Özbek, 2006; Kesen, 2007). Emmer type of wheat and durum wheats (*T. durum*) developed by mutations and selections in *T. Turgidum*. The origin of *Triticum monococcum* and *Aegilops speltoides* was Soth East Anatolia (Karagöz et al., 1996; Giuliangöz et al., 2009). However, the origin of Einkorn wheat (*Triticum monococcum*) was Mountain areas of North East Anatolia (Ardahan and Kars). Nutrient Content of Gacer has a great value for human nutrition. Modern wheat cultivars contain 12,3-14% proteins, Gacer wheat contains 17,3-19,6% proteins (Bulut, 2016). A hundred gram of antic cereals contain 31 mg Ca, 4.2 mg F, 153 mg Mg, 446 mg K, 4.3 mg Zn, 0.5 mg vitamin B1, 0.12 mg vitamin B2 and 1.7 mg vitamin E (Ünal, 2009). However modern wheat cultivars have significantly lower nutrient values than antic cereals.

The nutrition value of Gacer wheat

Gacer wheat has a great importance for human nutrition. Modern wheat cultivars contain 12-14% protein, but the improved emmer wheat cultivars contain 17-20% proteins (Marconi et al., 1999). The ancient wheat genotypes contain 31 mg Ca, 4.2 g Fe, 153 mg Mg, 446 mg K, 4.3 mg Zn, 0.45 mg vitamin B1 and 0.12 mg vitamin B2 and 1.7 mg vitamin E (Ünal, 2009). However, modern wheat cultivars contain lower amount of these minerals and vitamins (Marconi and Cubadda, 2005). Gacer wheat is a valuable source of dietary fibre, in its insoluble forms, cellulose and hemicelluloses (Ünal, 2009). As the quality of food products becoming more demanding, interest in this wheat variety is increasing (Hammer and Perinno, 1995).

The current situation of the hulled wheats

Hulled wheat is grown in dry areas of Italy, Spain, Austuria and Check Republic. Hulled wheats are grown by limited farmers in Kastamonu, Sinop, Kars and Kayseri-Develi. Hulled wheat planting area was 140 000 ha in 1964. But today, over 200 growers produce 100 tons of hulled wheat. Recent archeologic evidence in Karacadağ (Diyarbakır) and Çatalhöyük (Konya) showed that the origin of wheat was Anatolia. Gacer can be best grown in lands that have 20% slopes, shallow soil depth with rich in humus. Wheat is best adapted to well-drained, medium- to heavy-textured soils of high natural fertility, but Gacer wheat can be easily grown in poor soils. The highest yields are generally produced on silt and clay loams, but Gacer is also grown successfully on clay soils and fine sandy loams. The total hulled wheat area of Turkey is 14685 ha. Kastamonu has the highest hulled wheat cultivation area followed by Zonguldak and Samsun. Kayseri has only 50 ha hulled wheat planting area (Table 1).

Annual moisture requirement of Gacer wheat is between 300-400 mm. During the growing season, equally distributed rainfall is needed. The spring rainfall is very important for its growth. Gacer wheat is best grown in 1000-1400 m above sea level. The best soil type for Gacer wheat is shallow

soil, but for good growth it needs a fertile soil with good structure and porous subsoil for deep roots. The optimal soil reaction is slightly acid to neutral.

Gecer is grown as a spring wheat cultivar in Epce village of Develi. Develi, Kayseri has continental type of climate with cold, snowy cold winters and dry summers with cool nights (Table 2). Rainfall occurs mostly during the spring, early summer and late autumn. Cereals are the main crops in Develi (Table 3). Great amount of land is allocated for crop growth in Develi (Table 4).

3. RESULTS AND DISCUSSIONS

The cultivation of Gecer wheat is done under primitive conditions with limited area. Gecer is hulled wheat therefore; hulled seeds are used at planting. Broadcast planting is performed since the hulled structure of the grains blocks the drill. Broadcast seeding of Gecer can be done with a buggy and requires uniform seed application followed by incorporation with a mulches or harrow. Gecer is planted in March to early April. For this reason, delayed planting of spring Gecer wheat typically results in lower yields because of a shortened grain filling time. The seed depth is between 5-10 cm. During the planting 150 kg/ha seed is used. Compared with bread wheat, its tillering capacity is higher. Farm manure is used instead of chemical fertilizers. Hand weeding is applied. The crop is harvested when its color change from green to golden yellow. Mostly harvest is done by hand, because the Gecer fields are too small to operate combine.

The elevation of the plain is between 1080 m and 1165 m with an average slope of 2%. Develi Plain has an area of approximately 800 km². Summers are dry and hot in Develi. The temperature difference between the summer and winter is very high. July and August is the hottest months (35-36 °C) and January and February is the coldest (-15 - -18 °C) months. The annual mean temperature in the basin is 11 °C and the long-term mean annual precipitation is 363 mm. Gecer wheat is best suited for this climate ongoing in Develi.

Table 1. The hulled wheat planting provinces and planting areas of Turkey

Province	Cultivation area (ha)
Kastamonu	8280
Zonguldak	3200
Samsun	2192
Bolu	646
Sinop	300
Kayseri	50
Çankırı	20
Total	14685

Table 2. Long term climatic data for Kayseri

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean temperature (°C)	-1.7	0.1	5.0	10.7	15.1	19.2	22.6	22.1	17.2	11.6	5.1	0.5
Max. Mean temperature (°C)	4.1	6.1	11.7	17.7	22.4	26.8	30.6	30.7	26.5	20.4	12.8	6.5
Min. Mean temperature (°C)	-6.9	-5.4	-1.3	3.3	6.7	9.7	12.0	11.3	7.1	3.4	-1.1	-4.5
Mean sunshine duration (h)	3.0	4.0	4.6	6.1	8.3	10.3	12.0	11.3	9.1	6.5	4.5	2.6
Mean sunshine duration (h)	3.0	4.0	4.6	6.1	8.3	10.3	12.0	11.3	9.1	6.5	4.5	2.6
Mean rainy day	13.4	12.4	13.5	13.8	13.7	8.9	2.3	1.9	3.9	7.9	9.6	12.8
Mean monthly precipitation (kg/m ²)	33.8	35.5	41.6	54.8	51.6	39.9	10.3	5.4	12.7	28.5	33.1	39.9

Table 3. The major crops of Develi-Kayseri, Turkey

Crop	Planting area (ha)	Production (tone)	Yield (kg/ha)
Wheat	24.998	67.044	2680
Barley	6.999	22.107	3160
Rye	6.108	22.378	3660
Oat	58	141	2410

Table 4. The land use of Develi, Kayseri (ha)

Dry farming	Irrigated farming	Follow		Garden/vine yard	Prairie	Pasture	
		Dry	Irrigated			Barren land	Bottom land
73.990	11.463	23.870	1.074	4.469	3.000	73.226	8.137

4. CONCLUSIONS

Gacer wheat [*Triticum dicoccum* Schrank (Schuebl)] is a traditionally grown wheat species in small farming systems in Develi, Kayseri. In 1960s hulled wheat was grown in 1 million ha but now it is grown only in the limited areas due to the higher yielding capacity of modern wheat cultivars. Gacer is a hulled wheat species that began to be domesticated 10,000 years ago in the Levant region (Turkey, Iraq, Iran, Syria and Jordan). Gacer has attracted farmers because of its high quality of grain, which contains 17.0 – 20 % protein, a good supply of carotenoides and perfect characteristics for the production of bakery products without the use of yeast. As requirements for the diversity and quality of food products becoming more demanding, interest in Gacer wheat is increasing. The grains contain more crude protein than the grains of modern varieties. Whole meal of Gacer flour is a valuable source of dietary fibre, in its insoluble forms, cellulose and hemicellulose, and it contains high quantities of P, Zn, Cu, K, Mg and Mn. Gacer wheat seems a suitable crop for organic farming systems.

5. ACKNOWLEDGEMENTS

This research (Project No: FYL-2013-4502) was supported by Erciyes University Scientific Research Project Coordination Unit (ERU, BAP). The authors thank the ERU BAP for funding.

6. REFERENCES

- Aktaş, H. (2007). Türkiye orjinli yabani diploid buğday (*T.monococcum* spp. Boeoticum) popülasyonlarının morfolojik ve moleküler karakterizasyonu. *Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi* (MSc Thesis).
- Bulut, S. (2016). Mineral Content Of Develi Emmer Wheat (Gacer) Landraces (*Triticum turgidum* L. var. *dicoccum*). Unpublished.
- Frégau-Reid J., Abdel-Aal, E-S.M. (2005). Einkorn: A potential functional wheat and genetic resource. In: Speciality Grains for Food and Feed. E-S.M. Abdel-Aal and P. Wood (Eds.). Minnesota, *American Association of Cereal Chemists Inc.*, pp. 37-62.
- Giuliani, A., Karagöz, A., Zencirci N. (2009). Emmer (*Triticum dicoccon*) production and market potential in marginal mountainous areas of Turkey. *Mountain Research and Development*, 29(3), 220-229.
- Hammer, K., Perinno, P. (1995). Plant genetic resources in South Italy and Sicily: studies towards in situ and on farm conservation. *Plant Genetics Resources Newsletter*, 103, 19-23.
- Karagöz, A. (1996). Agronomic practices and socioeconomic aspects of emmer and einkorn cultivation in Turkey. *Hulled wheats, promoting the conservation and used of underutilized and neglected crops. IPGRI, Rome*, 172-177.
- Kesen, N. (2007). Anadolu orjinli yabani buğdayların RAPD-PCR yöntemiyle genetik akrabalıklarının belirlenmesi. *Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi* (MSc Thesis).
- Marconi, E.; Carcea, M., Graziano, M., Cubadda R. (1999). Kernel properties and pastamaking quality of five European spelt wheat (*Triticum spelta* L.) cultivars. *Cereal Chemistry*, 76, 25-29.

- Marconi, M., Cubadda, R. (2005). Emmer wheat. In: Speciality grains for food and feed. E-SM, Abdel-Aal and P. Wood (Eds.), *American Association of Cereal Chemists*, St. Paul, USA, pp. 63-108.
- Özbek, Ö. (2006). Yabani Tetraploit Buğday *Triticum turgidum* var. *Dicoccoides* (körn,schwein) Popülasyonlarında Genetik Çeşitliliğin Moleküler Markörler (AFLP, RFLP) ile Tespit Edilmesi. *Gazi Üniversitesi Fen Bilimleri Enstitüsü*, Doktora tezi, (PhD Thesis).
- Stallknecht, G.F., Gilbertson, K. M., Ranney, J. E. (1996). Alternative wheat cereals as food grains: Einkorn, emmer, spelt, kamut, and triticale. *Progress in new crops*, 156-170.
- Ünal, H.G. (2009). Some Physical and Nutritional Properties Of Hulled Wheat. *Tarım Bilimleri Dergisi*, 15(1), 58-64.