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**DETERMINATION OF SOME BARLEY (*Hordeum vulgare* L.)
VARIETIES SUITABLE FOR CYPRUS ECOLOGICAL CONDITIONS**

SUMMARY

This research was carried out on 6 barley varieties (two-rowed; Otis, Nure, Pewter Fouga, Prestige and six rowed; Athenais) in a Randomized Complete Block Design with three replications in 2008-2009 growing season in Cyprus; Turkmenkoy, Kumkoy, Tepebas and Haspolat locations. It was determined that the effects of genotype, environment and genotype x environment interaction were significant at 1% level of probability for grain yield. Grain yield varied from 61.0 – 410.5 kg/da. Kumkoy location had the highest grain yield (303.7 kg/da) while Turkmenkoy location had the lowest grain yield (118.3 kg/da). While, cultivars Nure and Pewter had the highest yield (250.0 and 261.4 kg/da), cultivars Fouga and Prestige had the lowest grain yield (156.3 and 158.0 kg/da) for all environments. While the highest grain yield is found in Kumkoy location with Nure (410 kg/da) and Pewter (400 kg/da), Turkmenkoy location has the lowest grain yield with Fouga (61 kg/da) variety.

Keywords: *barley, location, grain yield, cultivars*

INTRODUCTION

Cyprus is the third largest island in the North East of the Mediterranean Sea with 9251 km² area. However; the area of Northern Cyprus is 3298 km². By looking at the geographical location of the island; there are Besparmak Mountains which forms the Turkish side of the island and range from east to the west. Trodos Mountains on the other hand form the Greek side of the island and range on the middle part. There is arid Mesarya lowland between these two mountains and most of this part is this lowland. The western part of this region is called West Mesarya Lowland which is arable for irrigated farming as a result of groundwater springs in that region whereas on the East Mesarya dry farming is held mostly.

On the island where typical Mediterranean climate reigns over, the average precipitation is between 350-400 mm/year as well as altering per years. Precipitation is generally in dense in December-May (Statistics and Planning Division, 2011).

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134.3 million tons of barley is produced on 48.6 million hectare area in the world. The yield per decare is 276.3 kg In Turkey, the barley cultivation area is 3.4 million hectares and production amount is 7.6 million tons. Yield per decare is 232.0 kg and it is the second after wheat in grains (FAO, 2011). In North Cyprus, there is 124,000 ha cultivation area existing and Grain is cultivated in 84,000 ha area which corresponds to this land's %65-70. The largest share is barley (58,325 ha) with %93 ratio in grain lands then respectively wheat (4046 ha) with %6.5 ratio, oat (530 ha) with %1 ratio (Statistics and Planning Division, 2010).

The demand for barley has been increasing day by day which has a large usage area in feed and food industry. Although the livestock industry has improved in the country, the dry farming has spotlighted the barley due to insufficient pasture areas, limited water and precipitation and inability to cultivate roughage.

The barley cultivation area of North Cyprus is 80.7 thousand hectare and yield per decare is 208 kg which means below the average of Turkey and the world. This amount is not sufficient for the country and 51.000 tons of barley is imported average per year (Statistics and Planning Branch, 2011).

As being unable to increase the current cultivation sites; increasing the production amount from unit site is important and the variable to be used will contribute most importantly. In this study barley varieties which origin from Italy, France and Greece is tested in 4 different locations of Cyprus in terms of yield capability.

MATERIALS AND METHODS

This study is held in the producer lands of 4 different locations (West Mesarya-Kumkoy, North Coast- Tepebasi, Middle Mesarya- Haspolat, EastMesarya- Turkmenkoy) which represent different conditions of North Cyprus in 2008-2009 within the conditions without irrigation. 6 barley cultivars are used in the experiment and related information is given in Table 1.

Table 1. Information related to Barley varieties used in the Experiment

Cultivar Name	Country of Origin	Row Number
Athenais	Greece	6
Pewter	Greece	2
Otis	Italy	2
Nure	Italy	2
Prestige	France	2
Fouga	France	2

Areal precipitation per month, average relative humidity and average temperature per month related to the production years are given on Table 2. The soil types are different where the experiments were held and its characteristic features are given on Table 3.

Table 2. Climate Data related to 2008-2009 years

Months										
Average temperature (C°)		Nov	Dec	Jan	Feb	March	April	May	June	Period aver/total
	Turkmenkoy	17.2	11.9	16.6	17.0	18.8	24.6	28.7	34.6	21.2
	Tepebaşı	18.2	13.2	15.4	15.5	16.8	21.4	25.1	31.1	19.6
	Kumkoy	18.4	13.6	16.8	16.5	17.9	22.6	26.0	31.6	20.4
	Haspolat	17.4	12.0	11.3	11.6	12.2	17.1	21.8	28.1	16.4
Average relative humidity (%)	Turkmenkoy	64.0	67.7	72.0	76.3	70.7	62.0	51.9	44.2	63.6
	Tepebaşı	68.3	68.3	70.8	72.6	65.3	65.4	58.6	52.7	65.3
	Kumkoy	59.8	59.8	66.7	69.7	65.5	62.7	57.6	52.8	61.8
	Haspolat	63.4	67.7	71.6	78.3	70.1	61.7	50.9	41.6	63.2
Areal Precipitation (mm)	Turkmenkoy	20.6	61.9	49.5	40.4	51.4	27.4	18.3	0.7	270.2
	Tepebaşı	16.6	84.2	78.6	95.3	63.0	11.7	11.6	0	361.0
	Kumkoy	2.8	67.7	79.8	93.7	57.7	15.5	10.5	0	327.7
	Haspolat	9.2	49.3	41.3	28.9	40.1	22.5	9.4	0	200.7

Table 3. Soil Characteristics of Lands where the experiments were established

Location	pH	Lime (%)	Total Salt (%)	Organic substance (%)	Texture
Tepebaşı	7.4	22.0	0.06	2.30	Sandy-Loam
Turkmenkoy	7.8	36.6	0.05	1.22	Sandy-Loam
Kumkoy	7.3	14.1	0.05	1.30	Loamy-Sand
Haspolat	7.5	22.0	0.28	1.68	Argillaceous-Loam

The experiments were established in 3 replications according to Randomized Complete Block Design. The planting was done in parcels with 1.2 m width and 5m height to have 500 seeds per m². Each parcel included 6 plant lines with 20cm gaps. The parcels were dressed according to 8 kg/da pure N and 5 kg/da P₂O₅/da. The half of the Nitrogen and total Phosphorus was applied during the plantation and the remaining half of the Nitrogen will be applied at the beginning of bolting. In full-fledging period; from the sides of parcels 1 line each and from the parcel heads 50 cm each were cut and the remaining parts were harvested and blended by parcel combine harvester. The data obtained from the experiment were analyzed by JMP statistical package program and the differences in averages were compared by LSD test.

RESULT AND DISCUSSION

Turkmenkoy

The plantation of the experiment was done on 19.12.2008 with a grain drill. The experiment was established on a land where the organic substance and productivity is low and the soil is calcareous and its structure was destroyed

excessively. This land was chosen deliberately and rolling was done after plantation.

After about 15 days of planting, there was a good rain there was a perfect output in every types. Until the earing period, the plant progress began to regress due to decreasing rains and these decreasing rains in grain forming period have affected the productivity of all cultivars negatively. The experiment was harvested with parcel combine harvester on 11.05.2009.

In terms of rainfall during growing season, the second disadvantageous region is Turkmenkoy. Also, the obtained yield illustrates this openly. Great differences in terms of yield between variables are observed. On this location, the highest yield is obtained from Pewter with 162 kg yield decare, and then Athenais and Nure the followers of it. Again among these types; the earliest type is Athenais and latest is Fougá. Despite all the applications such as foreign plant control and tillage were in the optimum level, Turkmenkoy with 118 kg/da grain yield has been the location with the lowest average yield. It is obvious that; this is caused by bad soil conditions, rain amount and distribution on the plant growing period completely.

Tepebasi

The planting of experiment was done on 10.12.2009 with a grain drill and harvested on 01.06.2009. As can be seen the graph below, the obtained grain yield for all cultivars are above the country average and the average yield of this location is 233 kg/da.

Despite the antecedent precipitation and differences of soil structure, the performances of cultivars are similar to Turkmenkoy. While the highest yield in Tepebasi is obtained from Nurecultivar with 310 kg/da, Pewter (283 kg/da) has been the follower of it whereas the Athenais has been on the 4th line.

In case the environment becomes more convenient in terms of soil and climate; some cultivars which have high yield potential in good environment have become prominent. However; the types which have good performance in weak environment have dragged.

Kumkoy

This study was held in Kumkoy; a land 2 km far from the sea, very salty and previously hesperidium planting was done. However; the salinity was observed as not having a significant effect on barley.

The experiment was planted on 18.12.2009 with a grain driller and harvested on 13.05.2009.

Regarding the precipitation amount and soil conditions; the highest yields in all cultivars were obtained from this location. The average yield of the location is 304 kg/da. The highest yield is obtained from Nure cultivar with 410 kg/da and however the Pewter which had shown highest yields other locations has been on the second line with its 400 kg/da yield. Athenais on the other hand, has been on the fifth line with its 240 kg/da yield.

This experiment held in Kumkoy is a proof for obtaining very high yields in even one year from barley on the condition that using most suitable types for ecology.

Haspolat

On this field where it is close to water treatment unit of the municipality in Haspolat, planting was done with a grain driller on the 09.01.2009 and harvested on 11.05.2009.

Haspolat region is also the less rained land during plant growing period so; compared to other locations relatively, even though it has better soil conditions the grain yields here has been in very low level with 146 kg/da. The highest yield on this location is obtained from Nure cultivar with 185 kg/da and Pewter and Otis respectively. Athenais however has been on the fifth line.

General Evaluation of the Locations

The performances of types used in the experiment in different locations are given on the table below.

Table 4. The yields of cultivars in the experiments in different locations

	Turkmenkoy	Tepebasi	Kumkoy	Haspolat	Average
	Yield kg/da	Yield kg/da	Yield kg/da	Yield kg/da	Yield kg/da
Otis	113 i-k	205 d	308 b	170 f	199.0
Nure	140 gh	310 b	410 a	185 ef	261.4
Athenais	142 gh	200 de	240 c	120 h-j	175.4
Prestige	92 k	157 fg	245 c	138 g-i	158.0
Pewter	162 fg	283 b	400 a	155 fg	250.0
Fouga	61 l	240 c	219 cd	105 jk	156.2
Average	118.3	232.5	303.7	145.5	200.0
CV (%): 8.2 Lsd (0.05); Cultivar:13.5, Location: 11.0, Cultivar x Location: 26.9					

When the experiments are evaluated statistically; the effects of genotype, environment and genotype x environment interaction were significant at 1% level of probability for grain yield. While the highest grain yield is in Kumkoy location with Nure (410 kg/da) and Pewter (400 kg/da) types, the lowest grain yield is in Turkmenkoy location with Fouga (61kg/da) type.

When the locations are considered; the highest average yield is from Kumkoy with 304 kg/da and the lowest average yield is from Turkmenkoy with 118 kg/da. This difference is mainly caused by precipitation and distribution as well as subsidiary factors such as soil structure, etc.

When evaluating the types used in the experiments; the highest yield is obtained from Nure type with 261 kg/da according to average of grain yield in all locations and then respectively, Pewter 250 kg. and Athenais with 176 kg/da as

on the 4th line. The obtained results of Degirmenci et al., 2014 have shown similar results of the Degirmenci and Varoglu 2015 and Serinay et al., 2013 and Akerzurumlu 2014. However; these obtained results are found to be lower than Kirtok et al., 2001 results.

Although the results are for one year, while evaluating all cultivars and locations in this study can be said to be hint for barley agriculture.

CONCLUSIONS

Since the main limit in dry farming is water, the water efficiency of the cultivars used is expected to be high. Even the Athenais is used broadly and has more performance in weak and less rained environments; using this cultivar in the country in general is not a right choice. Giving advice according to the environment will provide better yields in normal rained years and better environments from the high potential cultivars and will make barley farming more economic.

Eliminating the effects of drought completely might be impossible with today's technology. However; spreading a science based farming in the system and minimizing the effects of drought should be the main target. With this regards; adding different variables to the production for different ecological zones of the country is possible and also integrating agronomic techniques which increase the water use efficiency makes barley farming more economic possible.

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