AN EXAMPLE TO APPLIED AGRICULTURAL CLIMATOLOGY: ÇORUM PLAIN AND ITS VICINITY

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Abstract

This paper explores an understanding and defining of drought based on the perception of farmers in Çorum plain and its vicinity. For this, the questionnaire survey was conducted between June and July 2001 and 2003 on 150 farmer families at nineteen village of study area and data were collected from them by direct interview. A compilation was made of monthly and daily climatic data at the Çorum State Meteorological Service Station. Analysis of interview data reveals that the 2001 drought affect plant growth, leading to loss of crop production and food shortages. There were no monetary support received by 100% of the farmers any official or non-official institution. In addition drought caused negative effects at positions social, economic and psychological of farmers as well.

***Keywords**: Crop, Çorum, drought, production, village.*

TARIMSAL KLİMATOLOJİ UYGULAMASINA BİR ÖRNEK: ÇORUM OVASI VE YAKIN ÇEVRESİ

Özet

Bu makale, Çorum ovası ve yakın çevresinde çiftçilerin kuraklığı algılamasını anlamaya ve belirlemeye yönelik bir çalışmadır. Bunun için 2001 ve 2003 Haziran ve Temmuz aylarında çalışma alanında bulunan 19 köyde 150 çiftçi ailesine anket uygulaması yapılmış ve veriler çiftçilerle doğrudan görüşmeler yoluyla elde edilmiştir. Aylık ve günlük iklim verileri Çorum Meteoroloji İstasyonu'ndan sağlanmıştır. 2001 yılı kuraklığı, bitkilerin büyümesini etkilediği, ürün kayıplarına ve yiyecek sıkıntısına yol açtığı yapılan görüşmelerden anlaşılmaktadır. Çiftçilerin hiçbiri tarafından resmi ya da resmi olmayan herhangi bir kuruluştan maddi destek alınmamıştır. Ayrıca kuraklık çiftçilerin sosyal, ekonomik ve psikolojik durumlarını da olumsuz etkilemiştir.

Anahtar Kelimeler: Üretim, ürün, Çorum, kuraklık.

Introduction

Drought has an impact on many aspects of society (Tadesse *et al.*, 2004) and it is an extreme weather event which affects (Hong *et al.*, 2004). Drought is one of the most important cause of decreasing of agricultural production (Shah *et al.*, 2003; Kirigwi *et al.*,2004). At some article, to examine effect of drought were used questionnaire and public survey methods (Cross, 1994; Ovuka *et al.*, 2000; Robinson, 1998; Stelik *et al.*, 2000; Valentine, 1993).

Drought has always been climatic hazard in some part of Turkey, especially inner regions. From this point of view, drought has been defined in terms of its social, political or economic impacts, in Turkey (Koçman, 1993; Nişancı, 1987; Nişancı, 1989;Türkeş, 1999) and Turkey has experienced droughts of major magnitude in 1973, 1984, 1989, 1990 and 2001 (URL, Türkeş, 2002) with prolonged periods of low rainfall during 1955-1967; 1970-1974; 1982-1993.

The drought of 2001 experienced in summer term 2001 (May, June, July, August, and September), at its worst, spread accross most of inner Turkey. The countinued drought led to shortfall of creals production. Example on an average, while creals were producted between 1/15-1/20 crop in every acre; at the period of drought, 1/2 - 1/5 be taken crop in every acre. That is, the yield was diminished between 75-95%. Also, farmers have become familiar with images of drought: the dying trees; the sad faces of farmers.

The primary objective of this study was to explore and analyze the ways and means by which residents of drought affected area adjust to drought conditions. The extent of damaged caused by the 2001 drought is also examined with the help of data collected from a sample survey conducted in Çorum plain and its vicinity .

Variables important in this context are occupational characterics, landhold size, and tenancy status. The household responses to the 2001 drought will be examined in relation to the above variables.

As such drought severely affect crop output in Turkey. Especially wheat grown in the dry season are also periodically affected by drought. Fruit trees often die during drought. Çorum plain and its vicinity were taken as model for the 2001 drought in Turkey. Because, Çorum has an important plain which it were grown of many crops(Wheat, barley, chickpeans, lentils, sugar beet…etc.).

1 Materials and methods

Questionnaire was used to collect household data from study area. Interviews were conducted with farmers and village chiefs. This questionnaire survey was conducted between June and July 2001 and 2003 on 150 farmer families at nineteen village in the study area(In 2001 with 100; in 2003 with 50 farmer families). These were administered by the researcher. Household data concerning the following issues was obtained: demographic data, socio-economic data, effects of climate variability, drought, past and current coping strategies, land use, financial implications; community support and official or non-official institution. It were interviewed with 101 men and 49 women. The interviews were carried out in the homes of the producers. Both method and questionnaire questions of this article were made use of Paul BK, 1995. "Farmers' And Publıc Responses To The 1994-95 Drought In Bangladesh: A Case Study", **http://www.colorado.edu/hazards/qr/qr76.html**. A compilation was made of monthly and daily climatic datas at the Çorum State Meteorological Service Station.

2 Description of the study area

The present study has been carried out in Çorum area, falling between the latitudes 40^0 16' to 40^0 44' North and longitudes 34^0 30' to 35^0 08' East (Fig. 1) and covering an area of 1490 sq. km. The slection of this study area was primarily affected by the 2001 drought. This area is a basin that its vicinity has with middle height mountains and its lower parts has plain (Fig. 2).

Çorum province contained population 597 065 in 2000. Total number of households 70 650; number of households not engaged in agricultural activity is 7 227; households engaged in crop production or households in both crop production and animal husbandry is 62 655 and, household engaged only in animal husbandy is 768; Number of settlements sawing field crops is 752 (SYT,1991).

As known, climate is one of the most important factors for agriculture. Turkey is subject to a "temperate climate type" (North of 40^0 latitudes) and to a Subtropical climate distinguished by dry summer south of this latitude. The northern district of Turkey (coastal zone) has a "humid-temperate climate type" and this zones receives annualy above 600 mm.of rainfall. For example, Samsun receive 670 mm. The inner districts, in contrast, receive less than 600 mm. e.g. Ankara 367 mm. (mean of 42 years), Konya 323 mm (mean of 45 years), and Çorum 401 mm (mean 41 years).

The climate of Çorum province is semi-arid with distinct seasonal variations, usually featuring hot- dry summers and cool- humid winters. Detailed annual patterns of climate variables were obtained from local weather station of Çorum. Monthly data for average temperature (41 years) and rainfall (41 years) were compared to the 2001 measurements to the Thorntwaite water balance table.

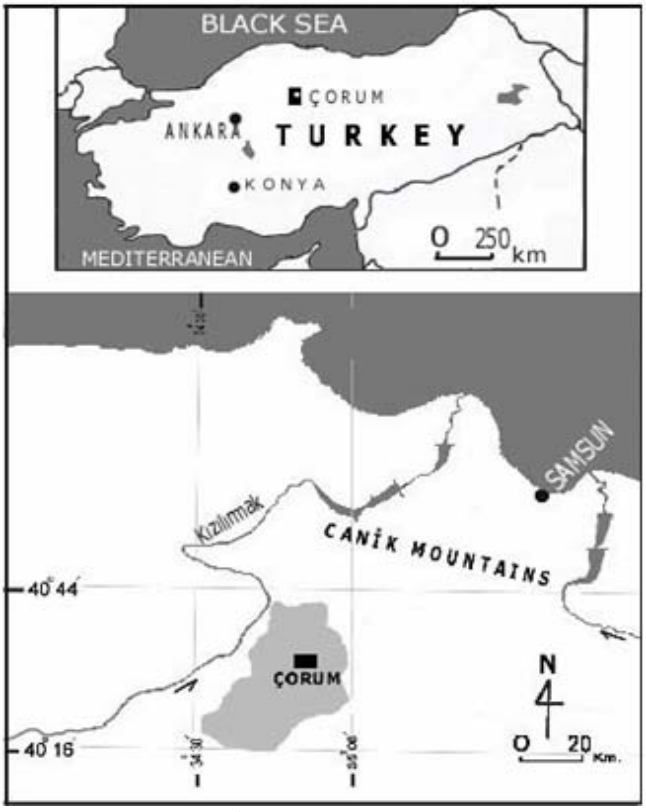

Fig. 1. Location Map

Farmers' perceptions are that crop production depends on rainfall and if it decreases or increases the output yield will change. Droughts have also been experienced in the past. The rainy season for 2001 has been irregular so far. It has been dry with high temperatures and very few

Mean monthly temperature reaches 20 ºC in July and August (Table 1). Precipitation is the key factor in controlling all aspect of the soil-water balance and undoubtedly, it has the biggest influence on soil processes such as the crop field variability of rain-fed agriculture. Mean monthly rainfall increases from 10,4 mm in August to 60,10 mm in May. Rainfall of total annual of Çorum is 401,10 mm. (Table 1). The climatic conditions of 2001 was the low amount of rainfall during winter and spring(except May)(Table 2), which meant that crops entered into the summer period with a large soil water deficit (Table 1 and 2). short showers.

Table 1. Thorntwaite water blance for Çorum (Between 1929-1970 years)

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Temperature (^{o}C)	-0,4	1,0	4,7	10,6	15,3	18,7	21,3	21,2	17,1	12,1	6,8	2,1	10,9
Temperature indices	0	0,9	0,91	3,12	5,38	7,37	8,97	8,91	6,44	3,81	1,59	0,27	47,67
Uncorrect PE (mm)	0	2,5	14	48	61	81	96	95	76	51	24	5,5	
Corrected PE (mm)	0	2	14,42	53,28	75,64	101,25	121,92	112,1	79,04	48,96	19,92	4,45	632,98
Precipitation (mm)	40	31,60	38,20	40,50	60,10	48,60	16,10	10,4	19,10	23	31,10	42,40	401,10
Storage change	40	10,87	0,0	12,78	15,54	52,65	19,03	0,0	0,0	0,0	11,18	37,95	
Storage	89,13	100	100	87,22	71,68	19,03	0,0	0,0	0,0	0,0	11,18	49,13	
Real evapotranspiration (mm)	0	2	14,42	53,28	75,64	101,25	35,13	10,4	19,10	23	19,92	4,45	358,59
Water defiency	0	0	0	0	0	0	86,79	101,7	60,3	25,96	0	0	274,75
Excessive water	0	18,73	23,78	0	0	0	0	0	0	0	0	0	42,51
Runoff (mm)	0	9,36	33,14	11,89	5,94	2,97	1,48	0	0	0	0	0	
Moisture ration	40	14,8	1,64	-0,2	-0,20	-0,52	-0,56	-0,90	-0,75	-0,53	0,56	8,52	

Table 2. Thorntwaite water blance for Çorum (2001 year)

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Temperature (^{o}C)	1,8	3,3	9,3	11,8	13,6	13,9	23,3	22,9	19,7	11,5	6,0	2,4	11,6
Temperature indices	0,9	0,53	2,56	3,67	4,55	4,70	10,28	10,01	7,97	3,53	1,32	0,33	50,35
Uncorrect PE (mm)	0	9,1	35	49	55	59	102	98	91	45	19	6	
Corrected PE (mm)	0	7,55	36,05	54,39	68,75	73,75	129,54	115,64	94,64	43,2	15,77	4,86	644,14
Precipitation (mm)	5,0	21,1	29,7	30,7	97,5	6,1	52,9	0,6	1,5	9,6	48,1	122,5	425,3
Storage change	0	0	6,8	23,69	28,75	40,76	0,0	0,0	0,0	0,0	32,33	67,67	
Storage	100	100	93,2	69,51	40,76	0,0	0,0	0,0	0,0	0,0	32,33	100	
Real evapotranspiration (mm)	0	7,55	36,05	54,39	68,75	46,86	52,9	0,6	1,5	9,6	15,77	4,86	298,83
Water defiency	0	0	0	0	0	26,89	76,64	115,04	93,14	33,6	0	0	345,31
Excessive water	5,0	13,55	0	0	0	0	0	0	0	0	0	85,31	103,86
Runoff (mm)	47,65	16,05	6,77	3,38	1,69	0	0	0	0	0	0	42,6	
Moisture ration	5	26,9	-0,17	-0,43	0,41	-0,91	-0,56	-0,99	-0,98	-0,77	0,67	24,2	

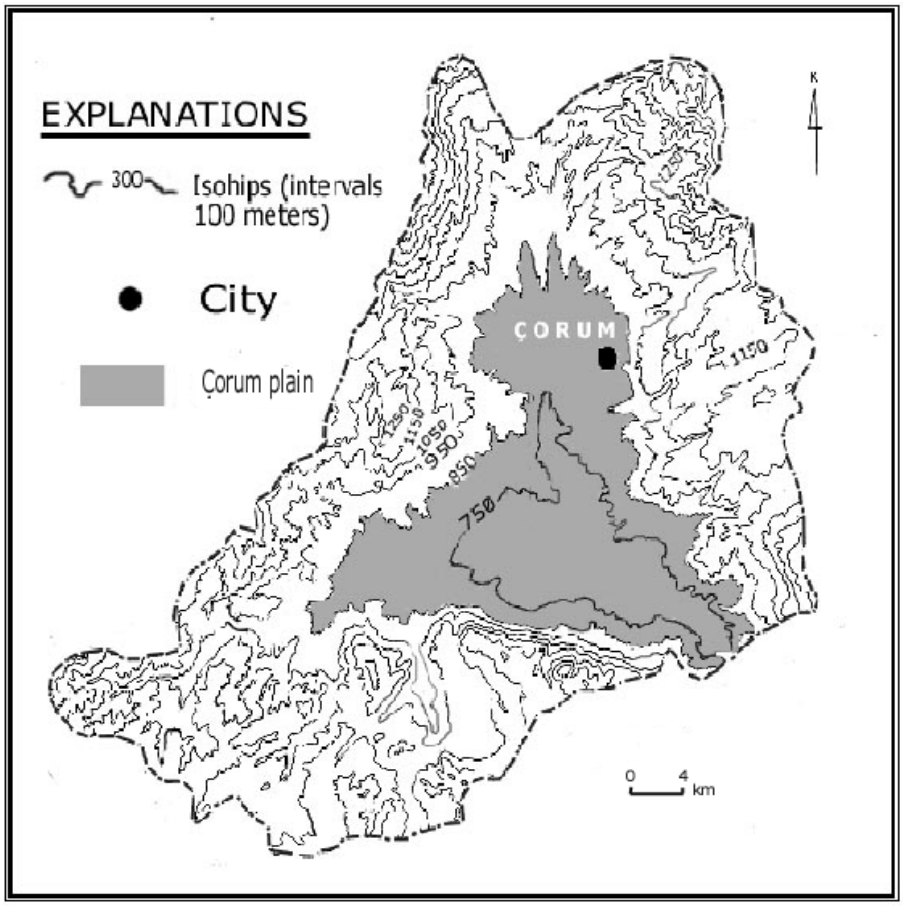

Fig. 2. The topographic map of study area

3 Questionnaire survey

It has been questionnaired at nineteen village at study area (Fig. 3). The villages were selected using a morphographic units (plain, plateau, mountains). The villages has an important for creal agriculture at use of land, and garden of vegetable and orchards has less area (decar) than sown crop area.

The primary sampling input of this study was individual households. A household is a group of people living together as a family and sharing the same kitchen. A sample size of 150 households were covered and the heads of sample households were interviewed with the help of a structured questionnaire. The interview was supplemented by informal post-interview discussion.

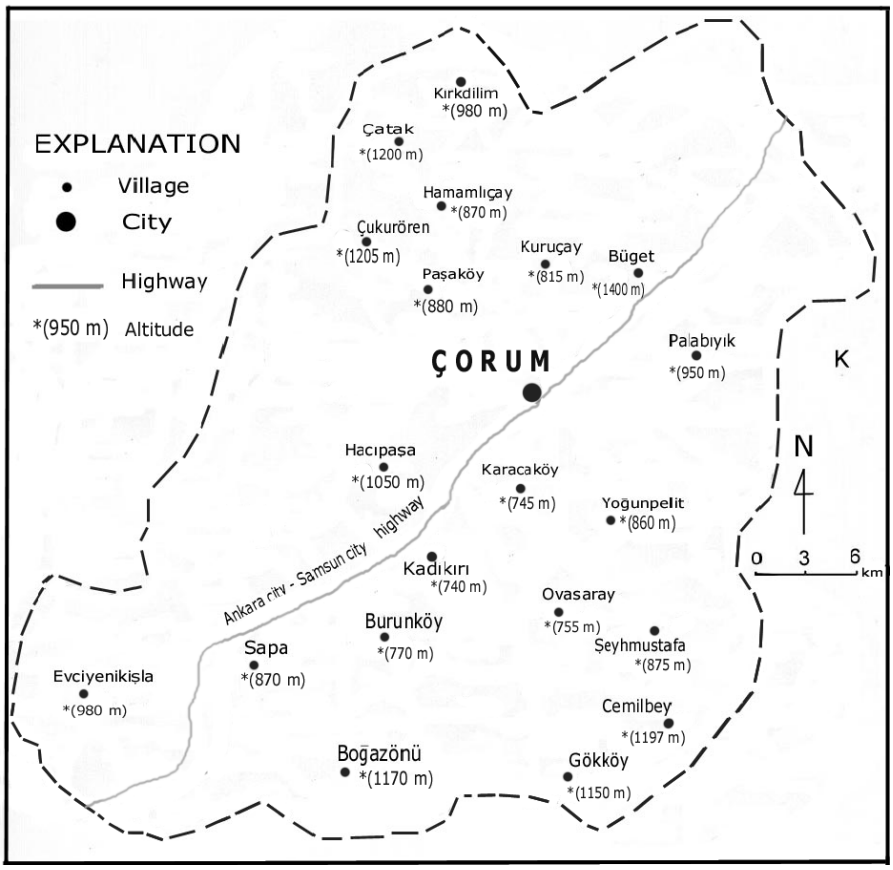

Fig. 3. The map of villages which were applied questionnaire

A profile of the sample households presenting selected socio-economic and demographic characteristisc of the head of the respondent households is given in Tables 3,4,5 and 6. The majority (69%) of households heads is above the age of 40 (Table 3). The small group (%5) is illiterate but majority(95%) have more than five years primary education(Table 4). Some attained secondary education and very few attained tertiary education and some farmers have additional occupation besides farming (Table 5). Among all the respondent households, 77 percent has owner (Table 6).

Table 3. Demographic features of the heads of the sample households

Age	Number	Percentage(%)
20-40	47	31
41-60	77	51
60<	26	18

Table 4. Different degrees of education of the heads of sample households

Education	Number	Percentage (%)
Illiterate	7	5
Primary education (include 5 yrs of schooling) and above	143	95
Total	150	100

Table 5.Some selected characterictisc of the heads of the sample households

Characteristic Occupation	Number	Percentage (%)
Farming	111	74
Farming+Civil servant	22	15
Farming+Truck driver	17	11
Total	150	100

Table 6.Tenancy Status of the Heads of the Sample Households

Ownership position	Number	Percentage (%)
Owner	116	77
Tenant	13	9
Share cropper	21	14
Total	150	100

Source: The results of questionnaire.

All households interviewed at least owned a piece of land. The land is used to cultivate crops for household consumption and some households produce for both commercial and household use. In order to cope with the adverse effects of the 2001 drought, the households practiced adjustments at the household level. Approximately, 53 percent of the farmers are also small farmers, they have got less land from 50 acres (Table 7).

Table 7.Landhold size of the sample households

Crop area (acre)	Number of households	Total crop area (acre)
5<	-	-
5-9	11	79
10-19	17	239
20-49	52	1817
50-99	39	2966
100-199	25	3356
200<	6	978
Total	150	9435

Source: The result of questionnaire.

4 Results

4.a Current land use

Crops are the most important products of agricultural production in sduy area. In 2001, crops are between creals(81%), industrial crops such as sugar beet and sun flower(3%), leguminosea (12%), and other crops such as dry onion, potatoes…etc(4%) in study area (Fig.4).

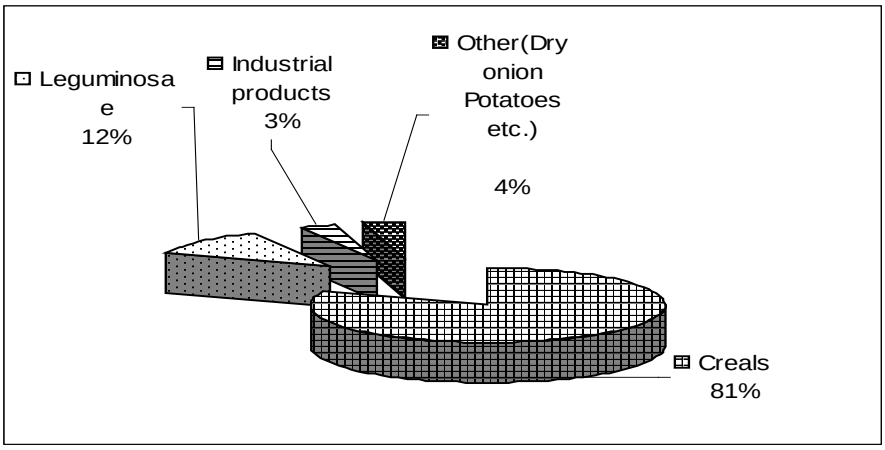

Fig. 4. The distribution of agricultural crops at study area for 2001 year

While creals area has been relatively stable during the period 1993 to 2002 in study area, output varied owing to changing yield. Wheat yields dropped to less than 2,100 t/ha in 1994 and 2001(Çorum Agricultural Province Directory, unpublished data).

The structure land use of the study area is characteristic by the complementarity of the eight main categories sown crop area(24%), fallow(6%), garden of vegetable(0,4%), vineyard and orchard(0,3%), unused and undeveloped potentialy productive land (0,3%), permanent pasture and meadow(34%), forest- woodland (28%) and non-agricultural land(stony and swam…)(7%) (Fig.5).

Permanent pasture and meadow changing the share of which in the territory depending on altitude. The share of permanent pasture and meadow is on the increase, from less than 30% in he mountain to over 45% in the plain(Fig. 5). On the other hand, the share of forest and woodlands decreases from over 35% mountain area to 13-9% in the low lands(plain, plateau).

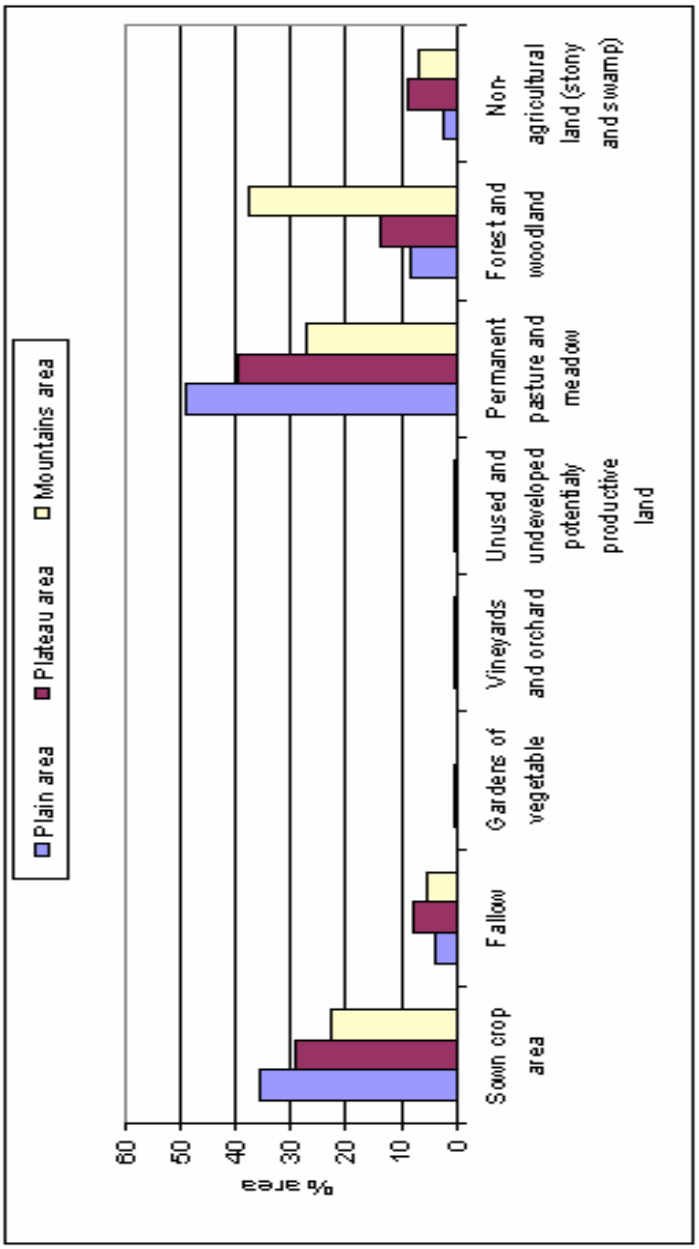

Fig.5. The land use of questionnaired village

Cultivated with vineyard and orchards (800 decar or 0,3%) situated in certain hilly and plateau areas at the heights of 800-1200 m. About 16,143 decar of studied area (nineteen village) could be considered as fallow land, which is an important form land use especially in dry regions(Fig. 5).

4.b Farmers' perceptions of drought

All of the 150 respondent households who either owned land an/or associated with farming as a share cropper, experienced crop damage due to the drought of 2001 and reported crop losses from drought during 2001.

The survey data shows that as at least six different crops were affected by the drought of 2001(Table 8). A large number of crops were damaged because the drought period corresponds with 2001 wheat, barley, lentils, sugar beet, sun flowers, vegetable

Table 8. Crop damage

Crop	Number	Percentage (%)
Wheat	115	77
Barley	97	65
Lentils	127	85
Sugar beet	145	97
Sun flowers	82	55
Vegetable	37	25

Source: The result of questionnaire.

The loss of annual crops, the extreme heat and lack of moisture caused loss of fruit trees (pears, apples, walnuts...). Based on the responses of the sample household, nearly 60 % to 70% of the wheat accreages were damaged by the drought. Percentage of crop losses from drought in 2001 change from low area (plain, plateau) to mountain area, due to height, irrigation conditions, soil caharacteristics and exposition.

Extensive investigations have shown that drought-induced shortages are invitable because of unexpected abnormal dry weather and the increasing need for water resources (McMahon *et al.*,2003; Shiau, 2003). From this point of view, the impact of large storage resevoirs depends on the use to which the water put. Many irrigation dams are located plain and its vicinity and the water is transferred to vertile soils along the artifical channels.

In informal interviewing with farmers were reported that they didn't loss any livestock, but other problems as lack of running water for household consumption, poverty and consumption of excessive fodder reserves for winter feeding were prevalent. Water deficit caused that there need water for irrigation and household purposes. Also, some diseases increased. However, drought caused disorders of behaviour of the people of the affected area such as nervous, ill-tempered, and aggressive.

There were diffirences in the way respondents perceived the drought. A majority of farmers considered drought to be a natural hazard, something that is impossible to preventing (60%). 22% of respondents consider drought to be a result of irregular and untimely rainfall and lack of irrigation (Table 9).

Table 9. The respondents thoughts about drought (Percentage)

Considerations about drought	Percent
Natural hazards that is impossible to prevent or be in a position to do something	60
Dryings of streams	5
Fall in crop income	5
Irregular and untimely rainfall	12
Fruit and vegetable deficiency	8
Lack of irrigation water	10

Source: The result of questionnaire.

The survey showed that no farmer (respondent households) received financial and other forms of support from official and non-official institution sources to cope with the drought hazard of 2001.

Many respondent households did not practice agricultural adjustments due to financial reasons. However, some cultivated wheat, lentils instead of sugar beet. Others had to rely on existing savings (food stocks, money and crops), secondary working, sell up their livestock, incoming retirement money, transporting (especially truck driver) and livestock and some had to borrow money from banks and get into debt (Table 10).

The survey showed that 23% of household adjusted to 2001 drought by selling their livestock. Five of the respondents had to mortgage their lands to cope with the financial consequences of the drought. It is worthwhile to mention that all respondents who had practiced agricultural adjustments also practiced non-agricultural adjustments. No members of the respondent households migrated to an other area. Of the respondent 35% spent previous savings or sold their valuable possessions to cope with the 2001 drought (Table 10).

Table 10. How did respondents cope with the 2001 drought (%)

By spending previous savings	35
Extra secondary working	13
Get into debt from banks	5
Work as transporter	15
Selling livestock	23
With income from retirement	9
Some family members moved to other city for incoming	-

Source: The result of questionnaire.

Conclusions

All of the respondents were affected by the 2001 drought. Drought was primarily perceived as a natural hazard by farmers. Unfavorable climatic conditions for agricultural production caused a 30-70% decrease at some crop such as wheat.

Many of respondents has livestock for living type. Drought affected livestocks by reducing the availability of fodder and grazing lands. Some households cannot afford any livestock.

Farmers did not get any support as money or food from office or non-office institute and They received some support from friends and relatives living at their village.

Drought caused shortage of water for irrigation and household purposes. Thereore, the incidence of some diseases increased due to water deficit and nutrional deficiencies. Drought caused disorders of behaviour of the people as nervous, ill-tempered, and aggressive.

The results showed that households adjusted to 2001 drought by selling their livestock and some had to mortgage their lands to cope with the financial consequences of the drought.

As a result, drought has not only meteorological and agricultural, but also socio-political dimensions.

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