

## An Investigation on the Flora of Ankara-Ahlatlıbel Dryland Range and Distributions of Some Important Range Plant Species<sup>1</sup>

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**Abstract:** The aim of this research was to determine the complete flora of Ahlatlıbel dryland range, near Ankara and to investigate the distributions of the most abundant and important range plants. The results were analysed using chi-square and coefficient of dispersion methods. The analysis showed that the distributions of *Stipa lagascae*, *Festuca ovina*, *Astragalus ovalis* and *Astragalus angustifolius* were fitted to the poisson distribution, while *Poa bulbosa* had a contagious distribution. Basal cover values of these five experimental species varied between 5.93% for *Festuca ovina* and 0.56 for *Astragalus angustifolius*. 109 plant species belonging to 77 genera in 27 families were found in the experimental area. It was observed that 13 plant species in the experimental area were decreaseers, comprising eight grasses, four legumes and one *Rosaceae* species. Nine species were increaseers; four grasses and five from other plant families. Thus, a total of 22 plant species out of 109 were identified as climax plant species for this region. The presence of so many plant species in approximately 1.5 ha of land, and the small proportion of climax plant species indicated that the condition of this dryland range was poor. Besides this, it was observed that there was not expected improvement in the vegetation of this range rested for 25-30 years.

**Key Words:** Flora, climax plants, poisson distribution, contagious distribution, cover percentage

### Ankara Ahlatlıbel Kıraç Mera Florası ve Bazı Önemli Bitki Türlerinin Dağılımları Üzerine Araştırma

**Özet:** Bu araştırma Ankara Ahlatlıbel kıraç merasının florası ve merada en çok bulunan bazı önemli mera bitkilerinin dağılımları hakkında bilgiler elde etmek amacı ile yapılmıştır. Merada en çok bulunan beş bitki türü üzerinde khi-kare ve dağılım katsayıları yöntemleri ile yapılan incelemelerde adi sorguçu otu, koyun yumağı, yuvarlak geven ve dar yapraklı geven bitkilerinin dağılımlarının poisson dağılıma uyduğu, yumrulu salkım otunun dağılımlarının ise contagious olduğu anlaşılmıştır. Araştırma bitkileri olarak seçilen beş bitki türünün dip kaplama değerleri en yüksek koyun yumağında %5.93 ile, en düşük dar yapraklı gevende %0.56 arasında değişmiştir. Araştırma alanında 27 familya ve 77 cinse ait 109 bitki türünün bulunduğu görülmüş ve alanın tam bir florası çıkartılmıştır. Bu bitki türleri arasında 8'i buğdaygiller, 4'ü baklagiller ve biride gülgiller familyasından olmak üzere 13'ü azalıcı; 4'ü buğdaygiller ve 5'i de diğer familyalardan olmak üzere 9 tanesi çoğaltıcı karakterde olmak üzere, 22 klimaks bitki türü belirlenmiştir. Yaklaşık 15 dönüm genişliğindeki araştırma alanında bu kadar fazla bitki türünün bulunması ve bunların arasında klimaks sayılabilecek bitki türlerinin sayı bakımından değilse bile miktar bakımından az olması nedeni ile meranın durumunun zayıf olabileceği sonucu çıkartılmıştır. Ayrıca 25-30 yıldan beri otlatılmayan meranın vejetasyonunda beklenen çapta bir iyileşmenin olmadığı gözlenmiştir.

**Anahtar Kelimeler:** Flora, klimaks bitkiler, poisson dağılım, contagious dağılım, kaplama oranı

#### Introduction

Despite the fact that Turkey has one of the largest livestock populations in the world, the livestock productivity and total livestock production fall well below the potential production. Animal feeding largely depends on grazing depleted natural range and pasture. As the portion of the improved pastures is really small, the majority of the livestock of the country has to graze on the unimproved poor natural rangelands. In pasture most of the livestock is supported by grazing on rangeland.

This situation is worsening day by day because the range area is diminishing and becoming less productive

as a result of excessive and uncontrolled grazing. Most of the range in Turkey has been deteriorated and lost their productivity. Generally, the vegetation cover is insufficient to protect the soil from the wind and water erosion.

It would be possible to save this natural resource and improve its productivity by implementing good management systems, including proper grazing systems and range improvement plans. These natural grazing lands have a great potential in increasing profits of the grazing sector of the national economy. These lands must also be protected for the benefit of the next generation.

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Few studies on range and pasture in Central Anatolia have been published (Büyükburç 1983a). It is difficult to initiate improvement and grazing plan studies at present, because of the lack of qualitative and quantitative information about our range vegetation in the various agricultural regions. It is essential to have information on the percentage cover and botanical composition of the vegetation in order to implement any range improvement measures successfully on these natural rangelands.

The first problem to be faced in a study of grazing land is the identification of plant species found in the vegetation. Therefore, floristic studies such as collecting, identifying should always be the first step in any range study (Hanson 1950). The agricultural traits of the plant species should then be investigated. Once sufficient information about the key species is available, further work to improve the vegetation through different treatment(s) can be done. Once the species present have been documented, grazing management and range improvement issues can be implemented. Any plan to improve natural feed resources in a particular area of range can be successfully implemented if it is based on a sound floristic knowledge of the area.

In this study the flora of Ahlatlıbel range in Ankara and the distribution of some plant species in this area were investigated. This study will form the basis for any further studies on similar range in the region.

#### Material and Method

The study site was dryland range in the Middle East Technical University Campus in Ahlatlıbel near Ankara. Measurements were made in 1989. This land is a typical mountainous step range, but it has been protected from grazing by a fence since 1961. Before grazing was restricted on this range it was exposed to heavy and uncontrolled grazing. After a careful inspection on the whole area, approximately one and a half hectares of land was chosen as the experimental area. The selected part was representative of the entire range. Protection from grazing has allowed to the development of a relatively good plant cover. However, the soil was shallow and stony, as it is common in Central Anatolia (Akalan 1963).

The precipitation in the study area was lower during the working year as compared with the long term mean annual precipitation (Table 1). All rainfed crops grown in dryland areas of Central Anatolia were affected by the low level of precipitation in 1989. Mean daily temperature and mean relative humidity for the 1989 were comparable to long term means.

#### Selection of the main plant species

It was not possible to conduct this research on all the plant species occurred in the area, therefore five

plant species were chosen for the study. The research area was carefully investigated to determine the most abundant plant species on which the study would be conducted.

#### Measurements of selected plant species

The line interception method is recommended by many researchers for vegetation measurements in dryland range (Conard 1953, Cook et al. 1962, Hutchings and Pase 1963, Bakır 1970b). This method was used to find out the proportions of ground cover of these selected species, and their distribution patterns. A hundred transect units were investigated.

The method described by Bakır (1970b) was used to calculate the species basal cover ratios. Distribution patterns of the species were clarified using two different methods. The first was the chi-square test described by Greig-Smith (1957) and Steel and Torrie (1960). The coefficient of distribution test used by Blackman (1942), Skellam (1952), David and Moore (1954) and (Bakır 1970b), was the second method to calculate the distribution patterns. Plant specimens collected from the experimental area were identified in the Herbaria of Ankara and Gazi Universities. The taxonomy of the Flora of Turkey and East Aegean Islands (Davis 1985) was also used. Turkish plant names were taken from Bakır and Özkaynak (1977). The list of climax plant species was based on Bakır's (1975) list for semi arid regions.

#### Results and Discussion

Three grasses (*Festuca ovina*, *Stipa lagascae*, and *Poa bulbosa*) and two legume species (*Astragalus angustifolius* and *Astragalus ovalis*) were identified by visual estimation as the most abundant species in the range. Hence, these species were subjected to further research. These species have previously been identified as some of the most common plants in Central Anatolian dryland ranges (Bakır 1970, Erkun 1972, Yılmaz 1977, Mülâyim 1980, Büyükburç 1983a). They are low yielding capacity and have low nutritional value. On the other hand, their plant growth characteristics allow them to survive in harsh conditions.

#### Distribution patterns

Table 2 shows distributions patterns of selected plant species. Species may show one of three different distribution patterns; normal, poisson and contagious. (Greigh-Smith 1957, Çetik 1973). Plants have a normal distribution pattern when coefficient of dispersion value is lower than 1. If the coefficient is greater than 1, the distribution pattern is described as contagious. The equality of this value to 1 indicates a poisson distribution (Tosun 1968, Bakır 1970b). All species investigated, except *Poa bulbosa* had a poisson distribution pattern. The distribution of *Poa bulbosa* was determined as contagious. Both types of tests gave the same results. However, in contrast to previous experiments (Tosun 1968, Bakır 1970b), most plant species showed poisson distributions. Previous authors also obtained different

Table 1. Climatic data of the experimental site for long term and during research year

Months	Long term means			1989		
	Precipitation (mm)	Av. temp. (°C)	Humidity (%)	Precipitation (mm)	Av. temp. (°C)	Humidity (%)
January	55.5	-0.2	77.9	6.5	-2.3	70.0
February	30.7	1.8	70.9	13.6	0.5	67.9
March	30.9	5.7	64.5	18.6	8.9	57.4
April	47.0	10.7	60.1	6.7	16.4	45.5
May	51.9	15.5	58.1	74.8	15.6	53.4
June	34.2	18.8	51.3	19.8	19.5	52.1
July	13.6	22.7	45.2	11.4	23.3	44.6
August	14.2	22.2	45.5	11.1	24.6	39.7
September	14.0	18.0	48.5	3.5	18.3	45.9
October	22.3	12.6	58.1	62.7	11.3	66.1
November	34.6	6.8	69.7	86.1	6.6	73.9
December	43.4	1.9	76.7	36.9	0.7	83.7
Total precipitation (mm)	392.3			351.7		
Mean temperature (°C)		11.39			11.95	
Mean relative humidity (%)			60.5			59.4

Table 2. Distribution patterns of selected plant species

Species	Coeff. of dispersion	"t" value	$\chi^2$	Table $\chi^2$	Distribution pattern
<i>Stipa lagascae</i>	1.174	1.74	5.911	9.448	Poisson
<i>Festuca ovina</i>	1.001	0.01	3.825	11.07	Poisson
<i>Astragalus ovalis</i>	1.138	1.38	1.464	5.991	Poisson
<i>Astragalus angustifolius</i>	1.200	2.00	5.618	5.991	Poisson
<i>Poa bulbosa</i>	1.550	5.50	32.259	11.07	Contagious

patterns for the same species. These results may have given rise to the idea that plants can show different distribution patterns in different region due to changes. The interaction among the plant species, grazing pressure, geographic events, and differences in climatic and soil conditions of the site affect the distribution patterns of plants (Hanson 1979).

The data obtained from the plants showing a poisson distribution pattern can be normalised using a square root transformation and then applied to the statistical formulas (Greig-Smith 1957). To populations which have a mean less than 10, a value of 0.5 should be added prior to square root transformation.

#### Floristic list of the area

In the experimental area of 1.5 ha the presence of 109 plant species belonging 77 genera in 27 families shows that this range is obviously rich in biodiversity (Table 3). This number of species is close to the number of plant species found by Büyükbucur (1983b) in deteriorated ranges of Ankara. However, the high number of the species found does not imply that the range is rich in forage. As stated by Bakır (1987) a high number of plant species indicates a low yielding range. The amount of climax plant species present in the experimental area also indicates that forage production in the experimental range is low.

#### Climax plant species of the area

Table 4 lists the climax plant species in the experimental site. Only 22 out of 102 plant species could be classified as the climax species for the experimental region. Only 13 of 22 are decreaseers which are the most valuable for the livestock feeding. The number of plant species found in this study is similar to the number recorded by many field studies in natural ranges of Turkey (Bakır 1970a, Erkun 1972, Andıç 1977). The work didn't quantify the amount of all species in the site, therefore it was not possible to evaluate the range condition. However, the floristic list produced indicates that the range was in poor condition for this precipitation belt.

#### Basal cover

The five selected species cover only 11.55% of the soil surface. *Festuca ovina* had the highest basal cover percentage as 5.93% (Table 5). This species was largely found in the Northern Hemisphere. Despite its relatively high contribution to the vegetation in many ranges, it is not a productive plant. *Stipa lagascae* was the second most common species in the vegetation. *Poa bulbosa* is a perennial grass but its growing period is very short which means that it does not produce much forage for animals.



Table 3. Flora of the experimental area

Scientific name	Turkish name
<b>Gramineae (Poaceae)</b>	<b>Buğdaygiller</b>
<i>Aegilops ovata</i> L.	Bodur buğdayotu
<i>Aegilops triuncialis</i> L.	Üçkılıklı buğdayotu
<i>Briza humilis</i> Bieb.	Başlıklı zembilotu
<i>Bromus erectus</i> Hudson	Dik brom
<i>Bromus japonicus</i> Thunb.	Japon bromu
<i>Bromus scoparius</i> L.	.....
<i>Bromus tectorum</i> L.	Kır bromu
<i>Chrysopogon gryllus</i> (L.) Trin.	Yeşil sakalotu
<i>Cynodon dactylon</i> (L.) Pers.	Köpek dişi
<i>Dactylis glomerata</i> L.	Domuz ayrığı
<i>Echinaria capitata</i> (L.) Desf.	Kır topuzotu
<i>Elymus hispidus</i> ssp. <i>barbulatus</i> (Schur)Meld.	Tüylü ayrık
<i>Elymus repens</i> (L.) Gould	Tarla ayrığı
<i>Festuca myuros</i> L.	Tavşan yumağı
<i>Festuca ovina</i> L.	Koyun yumağı
<i>Hordeum bulbosum</i> L.	Çayır arpası
<i>Koeleria cristata</i> (L.) Pers.	Sorguçlu gümüştü
<i>Pennisetum orientale</i> L.C.M. Richard	Doğu gök darısı
<i>Phleum pratense</i> L.	Kelp kuyruğu
<i>Poa bulbosa</i> L.	Yumrulu salkımotu
<i>Stipa lagascae</i> Roem et Sch.	Adi sorguçotu
<i>Taenatherum caput-medusae</i> (L.) Nevski	Kılıklı otlak arpası
<i>Trachnia distachya</i> (L.) Link	Yıllık yalancı brom
<b>Leguminosae (Fabaceae)</b>	<b>Baklagiller</b>
<i>Astragalus angustifolius</i> Lam.	Dar yapraklı geven
<i>Astragalus eriocephalus</i> Willd.	Çok başlı geven
<i>Astragalus hamosus</i> L.	Boynuzlu geven
<i>Astragalus ovalis</i> Boiss.&Bal.	Yuvarlak geven
<i>Astragalus vulnerariae</i> DC.	Yayık geven
<i>Coronilla varia</i> L.	Alaca taçotu
<i>Genista aucheri</i> Boiss.	Dağ katır tırnağı
<i>Hedysarum varium</i> Willd.	Alaca İspanyol korungası
<i>Medicago polymorpha</i> L.	Pıtraklı yonca
<i>Medicago sativa</i> L.	Yonca
<i>Medicago turbinata</i> (L.) All.	Dikenli fiç yoncası
<i>Onobrychis armena</i> Boiss.&Huet	Anadolu korungası
<i>Onobrychis vicifolia</i> Scop.	Korunga
<i>Trifolium arvense</i> L.	Tarla üçgülü
<i>Trifolium hirtum</i> All.	Tüylü üçgül
<i>Trigonella brachycarpa</i> (Fisch.) Moris	Topbaş çemen
<i>Trigonella corniculata</i> L.	Boynuzlu çemen
<i>Trigonella crassipes</i> Boiss.	Kır çemeni
<i>Trigonella monantha</i> C.A. Meyer	Narin yayla çemeni
<i>Trigonella monspeliaca</i> L.	Akdeniz çemeni
<b>Compositae (Asteraceae)</b>	<b>Bileşikgiller</b>
<i>Achillea spinulifolia</i> Fenz ex Boiss.	Civanperçemi
<i>Anthemis cretica</i> L.	Girit papatyası
<i>Anthemis tinctoria</i> L.	Sarı papatya
<i>Artemisia santonicum</i> L.	Kır yavşanı
<i>Carduus pycnocephalus</i> L.	Sıkbaşlı kangal
<i>Centaurea solstitialis</i> L.	Sarı peygamber çiçeği
<i>Centaurea virgata</i> Lam.	Çubuklu peygamber çiçeği
<i>Crepis</i> L. sp.	Hindiba
<i>Crupina crupinastrum</i> (Moris) Vis.	Mor benekli kantaron
<i>Xeranthemum annuum</i> L.	Yıllık kuzuotu
<b>Labiatae (Lamiaceae)</b>	<b>Ballıbabagiller</b>
<i>Phlomis armeniaca</i> Willd.	Anadolu alevotu
<i>Salvia cryptantha</i> Montbret&Aucher ex Bentham	Küçük çiçekli adaçayı
<i>Salvia tchihatcheffii</i> (Fisch.&Mey.) Boiss.	Adi adaçayı
<i>Scutellaria orientalis</i> L.	Doğu kalkancığı
<i>Stachyc iberica</i> Bieb.	Akdeniz karabaşotu
<i>Teucrium chamaedrys</i> Boiss.	Adi ipar yavşanı

<i>Teucrium orientale</i> L. <i>Teucrium polium</i> L. <i>Thymus squarrosus</i> Fisch.&Mey.	Doğu ipar yavşanı Koyun ipar yavşanı Kır kekliği
<b>Caryophyllaceae</b> <i>Arenaria ledebouriana</i> Fenzl <i>Dianthus crinitus</i> Sm. <i>Minuartia anatolica</i> (Boiss.) Woron. <i>Minuartia intermedia</i> (Boiss.) Hand.-Mazz. <i>Scleranthus uncinatus</i> Schur <i>Silene behen</i> L. <i>Silene chlorifolia</i> Sm. <i>Silene dichotoma</i> Ehrh.	<b>Karanfilgiller</b> Adi kumotu Tüylü karanfil Anadolu korootu Ortaboylu korootu Kancalı yumaklıot Yapışkan ot Yeşil yapışkanot Çatalı yapışkanot
<b>Umbelliferae (Amlaceae)</b> <i>Artemisia squamata</i> L. <i>Caucalis</i> L. sp. <i>Eryngium campestre</i> L. <i>Falcaria vulgaris</i> Bernh. <i>Malabaila</i> Hoffm. sp. <i>Torilis</i> Adans. sp.	<b>Şemsiye çiçeklilgiller</b> ..... Yaban maydonozu Adi çakır diken Tarla orakotu Tüylü maydanoz Şaytan havucu türü
<b>Cruciferae (Brassicaceae)</b> <i>Alyssum condensatum</i> Boiss.&Hauskn. <i>Alyssum lepidotum</i> Boiss. <i>Erysimum crassipes</i> Fisch.&Mey. <i>Erysimum torulosum</i> Hub.-Mor.	<b>Haçlı çiçeklilgiller</b> Sık kuduzotu Küçük kuduzotu Sık tatlı hardal Boğumlu tatlı hardal
<b>Boraginaceae</b> <i>Anchusa leptophylla</i> Roemer&Schultes <i>Myosotis ramosissima</i> Rochel ex Schultes	<b>Hodangiller</b> İnce yapraklı öküzdişi Dallı unutmabeni
<b>Dipsacaceae</b> <i>Pteroccephalus</i> Vaill. Ex Adanson sp. <i>Scabiosa rotata</i> Bieb. <i>Scabiosa argentea</i> L.	<b>Tarakotugiller</b> ..... Kömeçli uyuzotu Ukrayna uyuzotu
<b>Rosaceae</b> <i>Potentilla hirta</i> L. <i>Potentilla recta</i> L. <i>Sanguisorba minor</i> Scop.	<b>Gülgiller</b> Tüylü beşparmakotu Sarı başparmakotu Küçük çayır düğmesi
<b>Rubiaceae</b> <i>Cruciata taurica</i> (Willd.) Ehrend. <i>Galium aparine</i> L. <i>Galium floribundum</i> Sm.	<b>Kökboyasigiller</b> ..... Yapışkan yoğurtotu .....
<b>Euphorbiaceae</b> <i>Euphorbia myrsinites</i> L. <i>Euphorbia tinctoria</i> Boiss.&Huet ex Boiss.	<b>Sütleğengiller</b> Mersin sütleğeni Sarı sütleğen
<b>Scrophulariaceae</b> <i>Digitalis</i> L. sp. <i>Verbascum lasianthum</i> Boiss.ex Bentham	<b>Sıracotugiller</b> Yüksükotu Adi sığır kuyruğu
<b>Apocynaceae</b> <i>Vinca herbacea</i> Waldst.&Kit	<b>Zakkungiller</b> Otsu Cezayir menekşesi
<b>Cistaceae</b> <i>Helianthemum salicifolium</i> (L.) Miller.	<b>Ladengiller</b> Dar yapraklı güneşgülü
<b>Convolvulaceae</b> <i>Convolvulus lineatus</i> L.	<b>Sarmaşık giller</b> Çizgili sarmaşık
<b>Crassulaceae</b> <i>Sedum</i> L. sp.	<b>Damkoruğugiller</b> Damkoruğu türü
<b>Cyparaceae</b> <i>Bolboschoenus</i> Ascherson ex Pallas sp.	<b>Çayır sazları</b> .....
<b>Geraniaceae</b> <i>Erodium cicutarium</i> (L.) L'Hérit.	<b>Turnagagasigiller</b> Adi turna gagası

<b>Guttiferae (Clusiaceae)</b> <i>Hypericum</i> L. sp.	Kuzukıran
<b>Globulariaceae</b> <i>Globularia orientalis</i> L.	Doğu demir omcası
<b>Lillaceae</b> <i>Muscari botryoides</i> (L.) Miller	<b>Zambakgiller</b> Küçük yaban sümbülü
<b>Malvaceae</b> <i>Althaea</i> L.sp	<b>Ebegümeçigiller</b> .....
<b>Oleaceae</b> <i>Jasminum fruticans</i> L.	<b>Zeytingiller</b> Yabanî yasemin
<b>Orobanchaceae</b> <i>Orobanche</i> L. sp.	<b>Canavarotugiller</b> Canavarotu türü
<b>Plumbaginaceae</b> <i>Acantholimon</i> Boiss. sp.	<b>Kurşunotugiller</b> Kardikenî türü
<b>Ranunculaceae</b> <i>Ranunculus argyreus</i> Boiss.	<b>Düğünçiçeğigiller</b> Düğün çiçeği

Table 4. Climax plant species of the experimental site

Decreaser plant species	Increaser plant species
<b>G R A M I N E A E</b>	
<i>Agropyron trichophorum</i>	<i>Cynodon dactylon</i>
<i>Bromus erectus</i>	<i>Festuca ovina</i>
<i>Chrysopogon gryllus</i>	<i>Pennisetum orientale</i>
<i>Dactylis glomerata</i>	<i>Poa bulbosa</i>
<i>Elymus repens</i>	
<i>Koeleria cristata</i>	
<i>Phleum pratense</i>	
<i>Stipa lagascae</i>	
<b>L E G U M I N O S A E</b>	
<i>Hedysarum varium</i>	
<i>Medicago sativa</i>	
<i>Onobrychis armena</i>	
<i>Onobrychis viciifolia</i>	
<b>O T H E R S</b>	
<i>Sanguisorba minor</i>	<i>Artemisia santonicum</i>
	<i>Teucrium polium</i>
	<i>Teucrium orientale</i>
	<i>Thymus squarrosus</i>
	<i>Globularia oreintalis</i>

Table 5. Percentage cover of the selected plant species.

Plant species	Percentage basal cover
<i>Stipa lagascae</i>	2.41
<i>Festuca ovina</i>	5.93
<i>Astragalus ovalis</i>	0.94
<i>A. angustifolius</i>	0.56
<i>Poa bulbosa</i>	1.71
Total	11.55

The legume *Astragalus ovalis* produces small amount high quality forage and it is suitable for sheep grazing. *Astragalus angustifolius* covers 0.56% of the soils surface. It is a spiny species and is not suitable for grazing at maturity. Both *Astragalus* species are very effective at protecting the soil from erosion. Other species on the range had a basal cover percentage less than 0.56%, but the precise figures were not measured.

The presence of one hundred and nine plant species in a small area had a sign that this range was extremely deteriorated before its protection from grazing.

The experimental area has been protected from grazing for the last 30 years. In this long resting period there was little improvement in the vegetation of the site. The finding of inadequate improvement in vegetation after a 30-year rest agrees with Bakır's results (1987). Range improvement based on complete rest alone in arid and semi arid regions is very slow.

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#### References

- Akalan, İ. 1963. İç Anadolu'nun Tipik Mer'a Topraklarının Fiziki ve Kimyevi Özellikleri. A.Ü. Ziraat Fakültesi. Yayınları: 216, Bilimsel Çalışmalar: 140.
- Andiç, C. 1977. Erzurum Yöresi Çayır Mera Vegetasyonlarının Ekolojik ve Floristik Yönden İncelenmesi Üzerine Bir Araştırma. Doçentlik Tezi (Basılmamış), Atatürk Üniv. Zir. Fak. Tarla Bitkileri Bölümü, Erzurum.
- Avcıoğlu R. 1983. Çayır Mer'a Bitki Topluluklarının Özellikleri ve İncelenmeleri. Ege Üniversitesi Ziraat Fakültesi Yayınları No: 466.
- Bakır Ö. 1970a. Ortadoğu Teknik Üniversitesi Arazisinde Bir Mer'a Etüdü. A.Ü. Ziraat Fakültesi Yayınları:382, Bilimsel Araştırma ve İncelemeler:232.
- Bakır, Ö. 1970b. Vegetasyon etüd ve ölçmelerinde kullanılan bazı önemli metotların mukayesesi. A.Ü. Ziraat Fakültesi Yıllığı, Yıl 19: Fas.13'den ayrışım.
- Bakır, Ö. 1975. Mera Durumu ve Otlatma Gücü Rehberi. Başbakanlık Toprak ve Tarım Reformu Müsteşarlığı, Araştırma ve Eğitim Enstitüsü Başkanlığı, Sayı 3.
- Bakır, Ö. 1987. Çayır Mera Amenajmanı. A.Ü. Ziraat Fakültesi Yayınları: 992 Ders Kitabı:292. 362 s.
- Bakır, Ö., İ. Özkaynak, 1977. Yembitkileri İsim Kılavuzu. A.Ü. Ziraat Fakültesi Yayınları. 648 Yardımcı Ders Kitabı:202.
- Blackman, G.E. 1942. Statistical and ecological studies in the distributions of species in plant communities I. Dispersion as a factor in the study of chances in plant populations. Ann. Bot. Lond. N.S. 6:351-370.
- Büyükburç, U. 1983a. Orta Anadolu Bölgesi Meralarının Özellikleri ve İslahı Olanakları. Ankara Çayır Mera ve Zootekni Araştırma Enstitüsü Yayın No:80.
- Büyükburç, U. 1983b. Ankara İli Yavrucağ Köyü Meralarının Gübreleme ve Dinlendirme Yolu ile İslahı Olanakları Üzerine Bir Araştırma. Ankara Çayır Mera ve Zootekni Araştırma Enstitüsü Yayın No:70.
- Çetik. R. 1973. Vegetasyon Bilimi, Ülkemiz Matbaası. İzmir Cad. Sümer Sok. No.10/A Ankara.
- Cook, C.W., H.H. Biswell, R.T. Clark, E.H. Reid, L.A. Stodard and M.L. Upchurch, 1962. Range Research Basic Problems and Techniques. Pub. 890. National Academy of Sciences, National Research Council, Washington D.C.
- Conard, E.C. 1953. The Effect of Time of Cutting on Yield and Botanical Composition of Prairie Hay in Southeastern Nebraska. Unpublished Ph.D. Thesis.
- David, F.N., P.G. Moore, 1954. Notes on the contagious distributions in plant populations. Ann. Bot. N.S. 18:47-53.
- Davis, P.H. 1985. Flora of Turkey and The East Aegean Islands. Vol.1-9. Edinburgh University Press, 22 George Square, Edinburgh.
- Erkun, V. 1972. Bala İçesi Meraları Üzerinde Araştırmalar. TC Tarım Bakanlığı Hayvancılığı Geliştirme Projeleri Genel Müdürlüğü, Ankara.
- Greig-Smith, P. 1957. Quantitative Plant Ecology. Butterworths Scientific Publications, London.
- Hanson, H.C. 1950. Ecology of the grassland, II. Botanical Review Vol.16 No:6.
- Hutchings, S.S., C.D. Pate, 1963. Measurements of plant cover-basal crown, leaf area. Range Research Methods. A Symposium Denver, Colorado, May 1962. Miscellaneous Publication No:940 USDA Forest Service.
- Mülayim, M. 1980. Tabii Mer'ada Herbisitlerle Hazırlanan Tohum Yatağında Sun'li Mer'a Kurma Olanakları Üzerinde Araştırmalar. Doktora Tezi (Basılmamış), A.Ü. Zir. Fak. Tarla Bit. Bölümü, Ankara.
- Nalbantlı, G.M. 1964. İç Anadolu'da Bir Köy Ortamalı Mer'anın Bitki Örtüsü ve Otlatma Derecesi Üzerinde Araştırmalar. Doktora Tezi (Basılmamış), A.Ü. Zir. Fak. Tarla Bit. Bölümü, Ankara.
- Özmen, A.T. 1977. Konya İli Meralarının Bitki Örtüsü Üzerine Araştırmalar. Doktora Tezi (Basılmamış), A.Ü. Ziraat Fak. Tarla Bit. Bölümü, Ankara.
- Parker, K.W., D.A. Savage, 1954. Reliability of the line interception method in measuring vegetation on the southern Great Plains. J. Amer. Soc. Agr. 34(9):805-822.
- Skellam, J.G. 1952. Studies in statistical ecology, I Spatial Pattern. Biometrika, Vol.39:346-362.
- Steel R.G.D., J.H. Torrie 1960. Principles and Procedures of Statistics with Special Reference to the Biological Sciences. McGraw Hill Book Com. Inc. New York.
- Tosun, F. 1968. Transenkt Metodu ile Yapılan Mera Vegetasyonu Çalışmalarında Optimum Numune İntensitesinin Tespiti Üzerine Bir Araştırma. Atatürk Üniv. Zir. Fak. Ziraat Araç. Ens. Araç. Bül. No:27.
- Tükel, T. 1981. Ulukışla'da Korunan Tipik Bir Step Dağ Merası ile Eş Ortamalı Meraların Bitki Örtüsü ve Verim Güçlerinin Saptanması Üzerine Araştırmalar. Doçentlik Tezi (Basılmamış), Ç.Ü. Ziraat Fak. Tarla Bit. Böl. Adana
- Yılmaz, T. 1977. Konya İli Sorun Alanlarında Oluşan Meraların Bitki Örtüsü Üzerinde Araştırmalar. TC Köyleri ve Koop. Bakan. Toprak Su Gn. Md. Konya Bölge Toprak Su Araç. Ens. Md. Yay. No:46, Rapor No:32.