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Evaluation of Fescue (Festuca arundinacea Schreb. and Festuca rubra L.) Populations Grown under Aegean Region Conditions

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ABSTRACT: *A total of 43 materials of tall fescue (**Festuca arundinacea** Schreb.) and red fescue (**Festuca rubra** L.) were examined at experimental fields of Aegean Agricultural Research Institute (AARI) in the years of 2002 and 2004 in order to determine adaptation of species, populations and high yielding cultivars adapting to Aegean region. Populations were sown in multipods in 2001 and transferred to field with 1x1 m spacing in the spring of 2002. Characteristics observed were tillering, spring growth rate, time of 50 % inflorescence, abundance of inflorence, vegetative growth habit at inflorence, plant height, growth rate after cutting, dry matter yield and seed yield. Significant differences were observed between populations in terms of characters investigated. Dry matter yield was higher in tall fescue. There were significant differences between the populations in terms of spring growth. Tall fescue populations had higher spring growth rates. Flowering time of 50 % inflorescence of species and populations varied from early to late. In general, populations of red fescue had early 50% inflorescence time and also higher potential for abundance of inflorence. Significant differences were also found between populations in terms of their growth rate after cutting. Tall fescue populations showed higher growth potential. It was found that tall fescue and red fescue could be used with various purposes at Aegean Region.*

Keywords: *Tall fescue, **Festuca arundinacea** Schreb., red fescue, **Festuca rubra** L., evaluation.*

Ege Bölgesi Koşullarında Yetiştirilen Yumak (Festuca arundinacea Schreb. ve Festuca rubra L.) Populasyonlarının Değerlendirilmesi

ÖZ: *Ege Bölgesine uyumlu tür ve populasyonları belirlemek için kamışsı yumak (**Festuca arundinacea** Schreb.) ve kırmızı yumak (**Festuca rubra** L.) türlerine ait toplam 43 adet populasyon 2002 ve 2004 yılları arasında Ege Tarımsal Araştırma Enstitüsü (ETAE) deneme tarlasında gözlemlendi. Populasyonlar 2001 yılında multipodlarda çimlendirildikten sonar 2002 yılının ilkbaharında 1m x1 m aralıkla tarlaya aktarıldı. İncelenen özellikler; kardeşlenme, ilkbahar büyüme hızı, yüzde elli başaklanma, başaklanma durumu, başaklanmada bitki gelişim özelliği, bitki boyu, biçimden sonra büyüme hızı, kuru madde ve tohum verimi olmuştur. İncelenen karakterler açısından populasyonlar arasında önemli farklılıklar gözlenmiştir. Kamışsı yumak populasyonlarından daha fazla kuru madde verimi alınmıştır. İlkbahar gelişim hızları açısından populasyonlar arası önemli farklılıklar tespit edilmiştir. Kamışsı yumak populasyonları daha yüksek ilkbahar gelişme hızı göstermişlerdir. Yüzde elli başaklanma türler ve populasyonlar arsında erkenciden geççiye kadar değişim göstermiştir. Genel olarak kırmızı yumak populasyonları daha erkenci başaklanma özelliğine ve daha yüksek başaklanma potansiyeline sahip olmuşlardır. Biçim sonrası büyüme açısından da populasyonlar arasında önemli farklılıklar bulunmuştur. Kamışsı yumak populasyonları daha yüksek büyüme potansiyeli göstermiştir. Kamışsı ve kırmızı yumak türlerinin bu çalışma ile Ege Bölgesinde farklı amaçlar için kullanılabileceği tesbit edilmiştir.*

Anahtar kelimeler: *Kamışsı yumak, **Festuca arundinacea** Schreb., kırmızı yumak, **Festuca rubra** L., değerlendirme.*

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INTRODUCTION

Although there is a great number of an animal existence in Turkey, animal production is very low. One of the main reasons for this is that animals can not feed with enough good quality forages. The most important feed sources are pastures used for grazing and composed of forage crops such as alfalfa, vetch and sainfoin grown as field crops.

Occupation of forage crops in field crops is rather low in Turkey. It is necessary that forage crops sowing area be expanded, intercrop and rotation crop possibilities be investigated, and high yielding forage crop varieties be improved. Although there are some cultivars of vetch and alfalfa, for lots of forage species particularly for perennial grasses the number of improved varieties is far beyond the demand.

Since having various plant species with important plant nutrients, pastures are very important in animal nutrition. But pastures have lost their yield potential very much due to early and heavy grazing. This results in reduction of animal nutrition as well as the danger of soil and water losses because of erosion.

It was shown that *Festuca* species could be used for this reason besides other forage grasses (Aydin et al., 1994 ; Silbir et al., 1994; Tukel et al., 1999).

Aydin et al. (1994) stated that red and tall fescues maintained 7190 and 10 200 kg ha^{-1} dry hay and 473 and 871 kg ha^{-1} protein yield respectively without irrigation and claimed *Festuca* species could be grown under Samsun and similar climatic conditions. Silbir et al., (1994) had 42130-62550 kg ha^{-1}green hay and 10530-17770 kg ha^{-1} dry hay yields from different fescue species (*F. arundinacea, F. ovina, F. rubra*). Serin et al., (1997) found that mixtures of white clover with perennial grass, creeping red fescue, smooth brome grass and bird's foot trefoil with creeping red fescue, perennial grass, creeping red fescue, smooth brome grass gave high yields of dry hay.

Campbell and Xia (2002) who carried out an experiment in order to evaluate germplasm collected from pastures typically heavily grazed in Mongolia and Chine Xinjiang District found that there were big variations among and within species of *Bromus inermis* Leyss., *Dactylis glomerata* L., *Festuca arundinacea* Schreb., *Festuca ovina* L., *Festuca rubra* L., *Phleum phlooides* (L.), Karsten, *Phleum pratense* L., *Poa palustris* L., *Poa pratensis* ssp. *angustifolia* (L.), H. Lindb., *Medicago sativa* ssp. *falcata* Arcengelii; *Medicago sativa* L.ssp. *sativa*, *Medicago lupilina* L., *Medicago ruthenica* (L.), Ledebour, *Trifolium fragiferum* L., *Trifolium lupinaster* L., *Trifolium pratense* L., ve *Trifolium repens* L. in terms of 50 % heading time (for grasses) or flowering time (for legumes), blade shape (for grasses), growth habit, winter hardiness and dry matter yields.

Gibson and Newman (2001) informed that *Festuca arundinacea* with a good adaptation capability is common as native grass at wide variety of climatic and soil conditions of all Europe, North Africa, West and Middle Asia.

MATERIALS AND METHODS

Seventeen tall fescue (*F. arundinacea*) and 26 red fescue (*F. rubra*) populations obtained from different sources were used in this work. All materials were germinated in multipods at glass house. 376 tall fescue plants and 332 red fescue plants were transplanted to the experimental field of the AARI in 2001. The following characters were measured during 2002, 2003 and 2004 in the field as spaced plants with dimension 1m x 1m.

Characters observed were as follows;

Tillering capacity: scaled visually in first year (1=very few tillers; 9=very numerous tillers)

Spring growth rate: growth by the first week of April (1= very low; 9= very high)

Abundance of inflorescence: visual estimates of the number of inflorescences per plant at heading (1 = very low; 3 = low; 5 = intermediate; 7 = high;

9 = very high) when 50% of plants reached inflorescence emergence in the year following establishment.

Time of 50 % inflorescence emergence: When 50% plants reached inflorescence in the year following establishment (1= very early; 3=early; 5=intermediate; 7=late; 9=very late).

Time of 50 % anthesis: when 50% plants reached anthesis in the year following establishment (1= very early; 3=early; 5=intermediate; 7=late; 9=very late).

Vegetative growth habit at inflorescence: expressed as the mean angle of tillers from vertical (1=prostrate; 9 erect).

Plant height (cm): distance from soil surface to top of panicle.

Growth rate after cutting: growth at third week after cutting (1= very low; 9= very high).

Dry matter yield (g/plant): plant weights after oven-drying at 78 ^{o}C for 48 hours.

Seed yield (g/plant): single plants were harvested separately at seed maturity time. They were thrashed, cleaned and weighed. Average seed yield of single plants were taken as mean population seed yield.

Data was subjected to Student's t-test in order to study differences between the populations (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

The differences among populations were found to be significantly important in terms of characters investigated.

From the point of dry matter yield, the differences between populations were statistically important (t=33.9). *Festuca arundinacea* gave more dry matter yield than *Festuca rubra* (Figure 1).

With regard to tillering capacity, the differences between populations were significantly important (t=66.9) although populations showed high tillering capacity. The highest values were obtained from *F. rubra* populations (Figure 2).

In relation to plant height, the differences among the populations were found to be important (t=54.5). While *F. arundinacea* gave the highest plant heights, the minimum plant heights were maintained within *F. rubra* populations (Figure 3).

With relation to spring growth, significantly important differences were determined between populations (t=44.3). *F arundinacea* populations gave much higher spring growth ratios. (Figure 4).

Differences among populations were significantly important in terms of 50 % inflorences time (t=32.1). Population ranked form very late to early. In general, *F. rubra* populations maintained earlier 50 % inflorences time (Figure 5).

Differences between populations were found to be significantly important with relation to 50 % anthesis (t=38,9). Populations demonstrated a wide range of anthesis time form early to very late. *F. rubra* populations generally had early anthesis time (Figure 6).

The differences among populations were significantly important with regard to heading potential (t=59,6). Population ranked from poor to very good heading potential. In general, *F. rubra* populations had higher heading potential than other species (Figure 7).

Differences among populations were important in relation to re-growth after cutting (t=64,4). *F. arundinacea* populations had faster re-growth (Figure 8).

The differences among populations were found to be significantly important as regard with growth habit at inflorences stage (t=85,5). Populations exhibited growth habit from erect to half decumbent (Figure 9).

The differences among populations were found to be significantly important as regard with seed yields (t=65,2). *F arundinacea* populations gave much higher seed yields (Figure 10).

It was determined in different studies that *F. arundinacea* had superiority over other species in terms of dry matter yield (Aydin et al., 1994; Campbell and Xia, 2002). This trait that is important for yield may be attributed to high plant height and fast regrowth rate after cutting. In addition to this, early and strong spring growth could have effect on it.

With relation to tillering capacity, *Festuca rubra* populations gave more tiller numbers because of it's rhizomatous growth habit (Genckan, 1983). Similar differences and variation in spring growth, time of 50 % anthesis, time of 50 % inflorescence, abundance of inflorescence, growth rate after cutting were found in various studies (Campbell and Xia, 2002; Gibson and Newman, 2001). Some important morphological and physiological traits designate adaptation capacity and yield performance of species. *Festuca* species can adapt to different climatic conditions because they have a wide range of variation in their characteristics. Both species had populations with high seed yield capacity. Because of this important character, seeds of species, particularly F. *arundinacea* can be produced in sufficient quantity with reasonable, competitive price in Turkey.

It is very clear that chances of *Festuca* species to be used as forage and pasture plants in our region are very high because of having a wide range of variation in their characteristics. *F. arundinacea* populations can be used both as forage and pasture plant due to their fast and strong growth and high dry matter yield while using *F. rubra* populations with strong tillering capacity and rhizomes as more pasture plants to improve natural grassland seems to be more suitable. Besides, both species could be used as turf grasses.

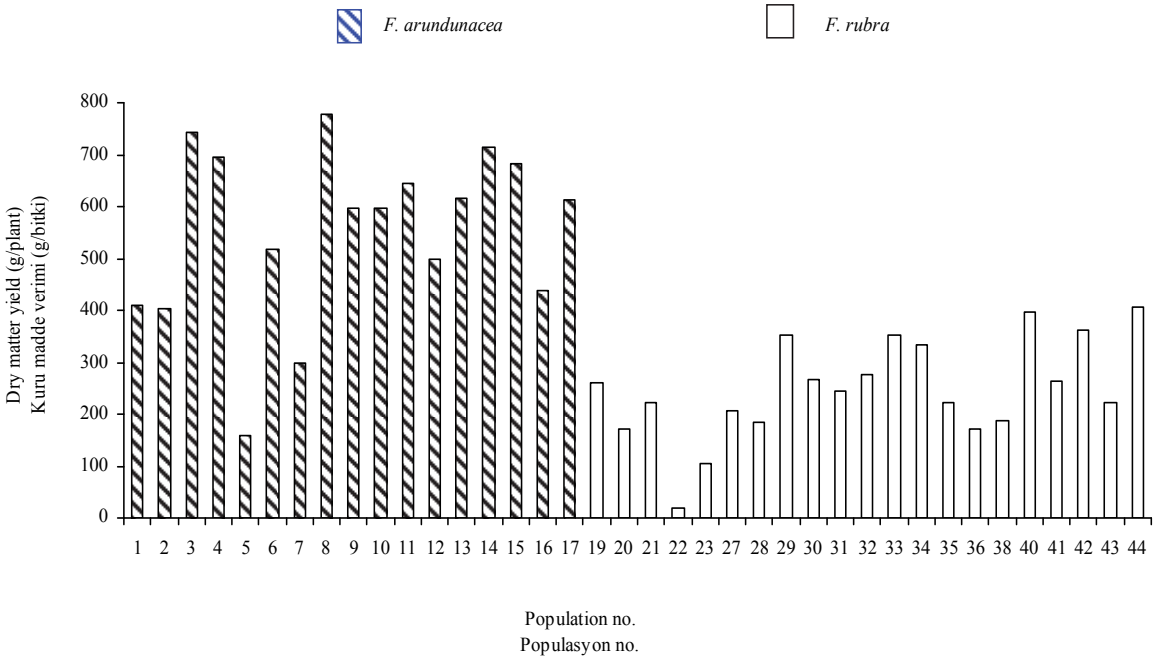

Figure 1. Dry matter yields of *Festuca* populations (g/plant).
Şekil 1. Yumak populasyonlarının kuru madde verimleri (g/plant).

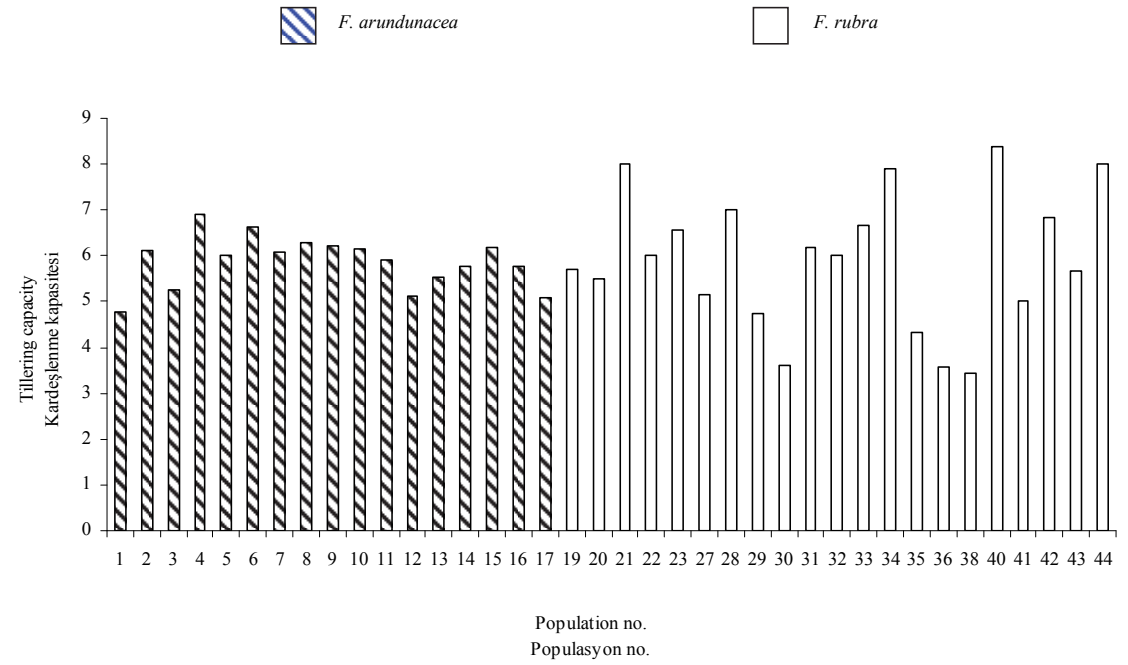

Figure 2. Tillering capacity of *Festuca* populations.
Şekil 2. Yumak populasyonlarının kardeşlenme kapasitesi.

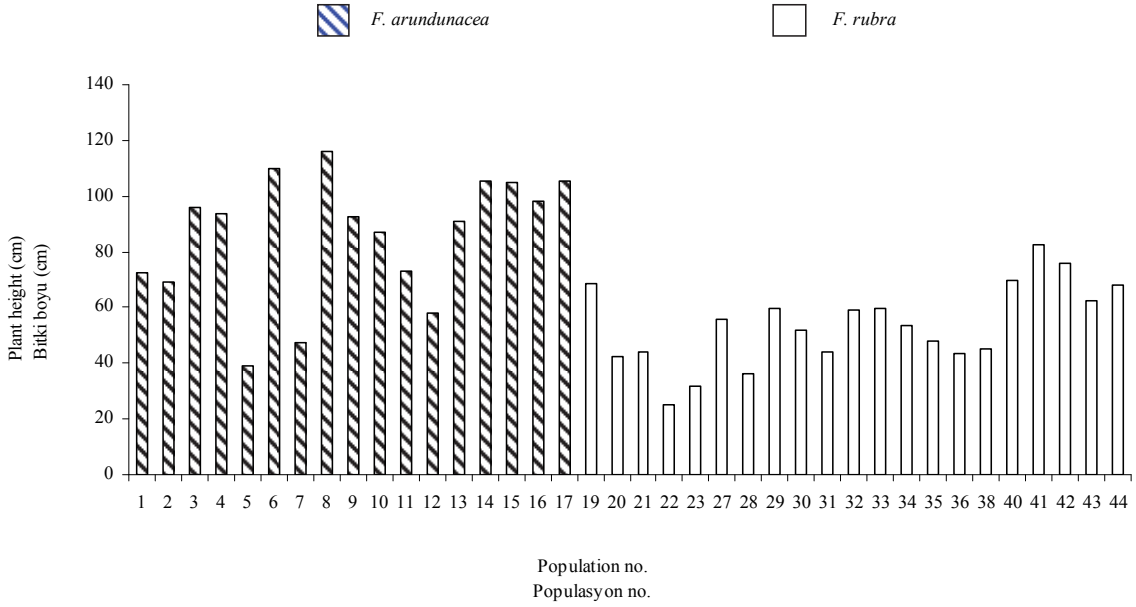

Figure 3. Plant heights of *Festuca* populations.
Şekil 3. Yumak populasyonlarının bitki boyları.

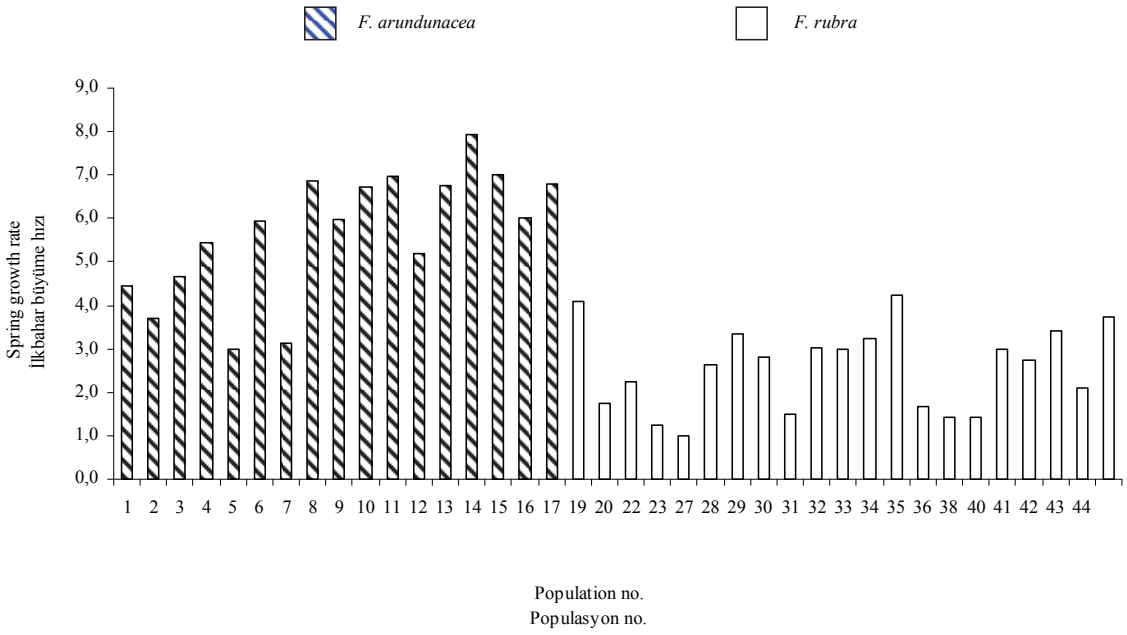

Figure 4. Spring growth rates of *Festuca* populations.
Şekil 4. Yumak populasyonlarını ilkbahar büyüme oranları.

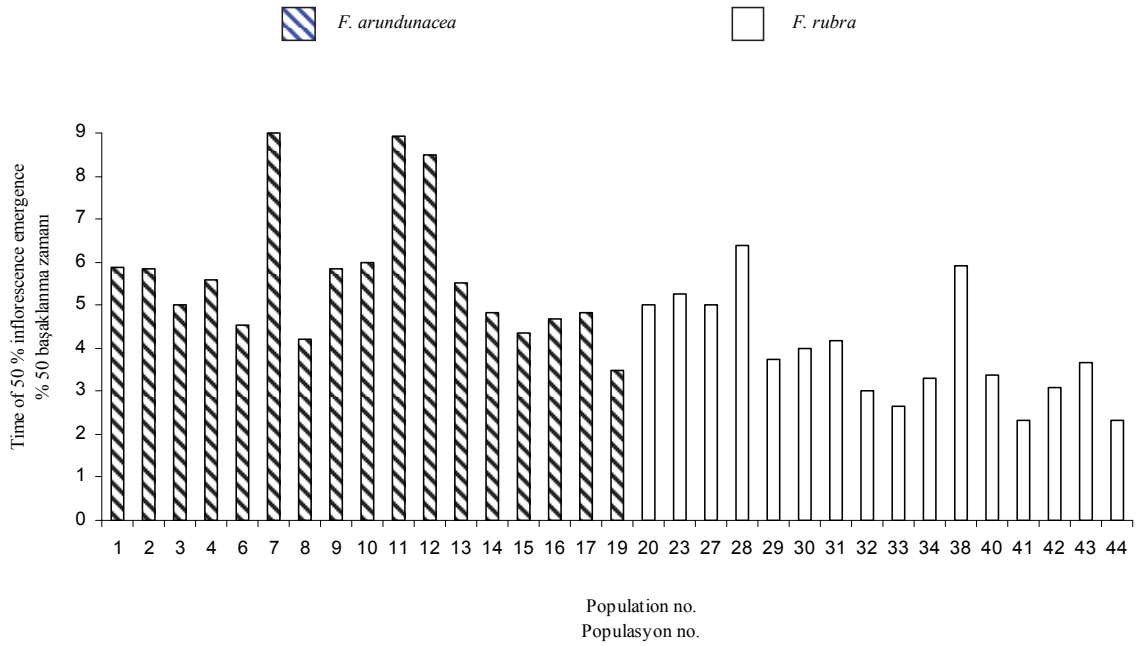

Figure 5. Time of 50 % inflorescence of *Festuca* populations.
Şekil 5. Yumak populasyonlarının %50 başaklanma zamanı.

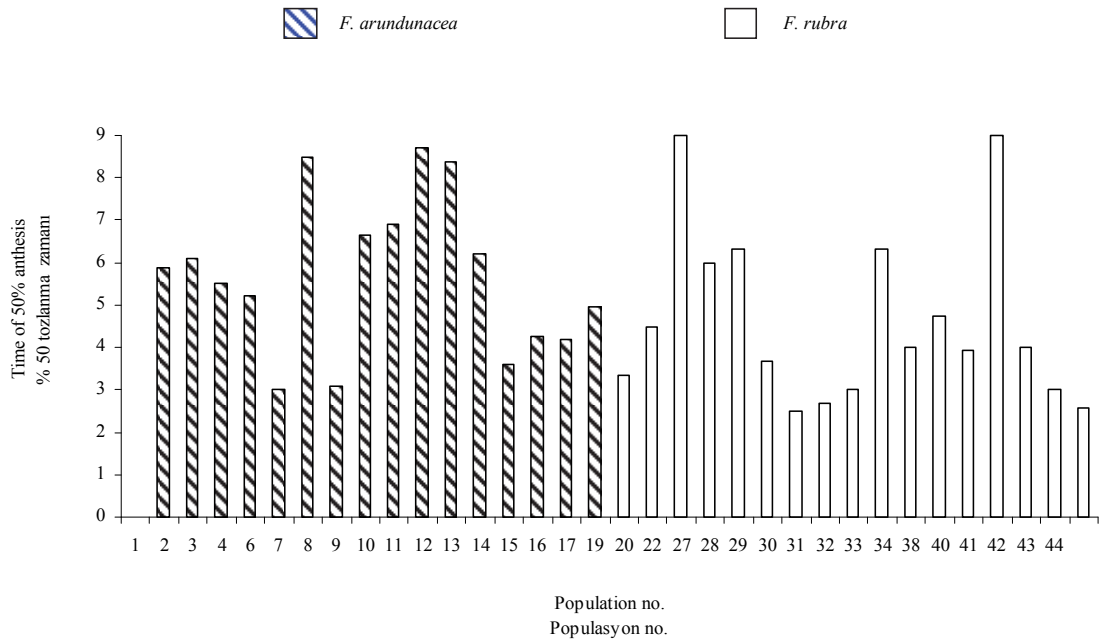

Figure 6. Time of 50 % anthesis of *Festuca* populations.
Şekil 6. Yumak populasyonlarının % 50 tozlanma zamanı.

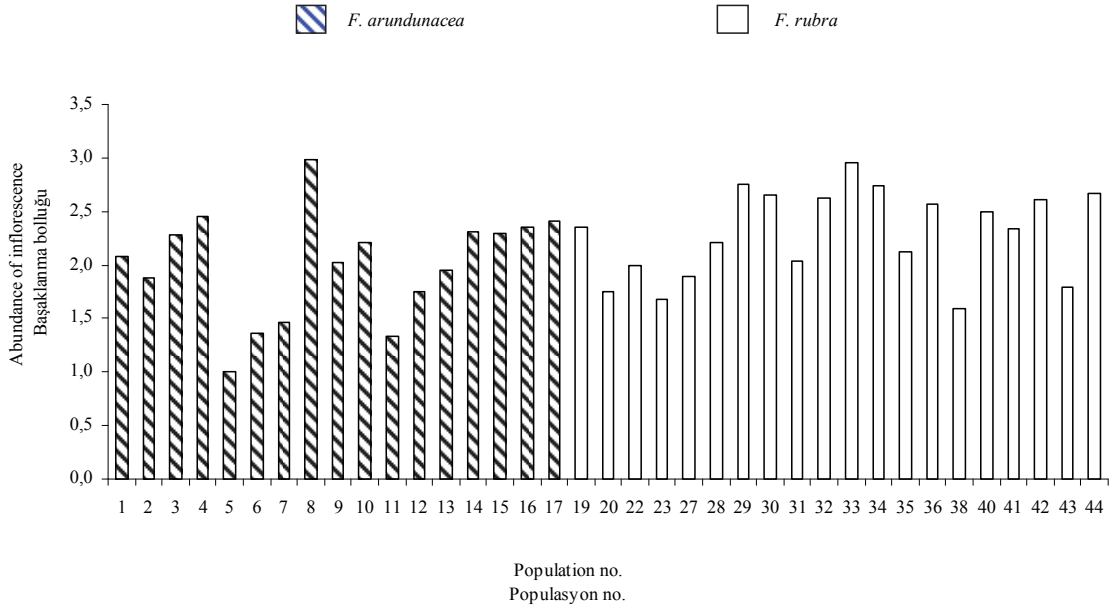

Figure 7. Abundance of inflorescence of *Festuca* populations.
Şekil 7. Yumak populasyonlarının başaklanma bolluğu.

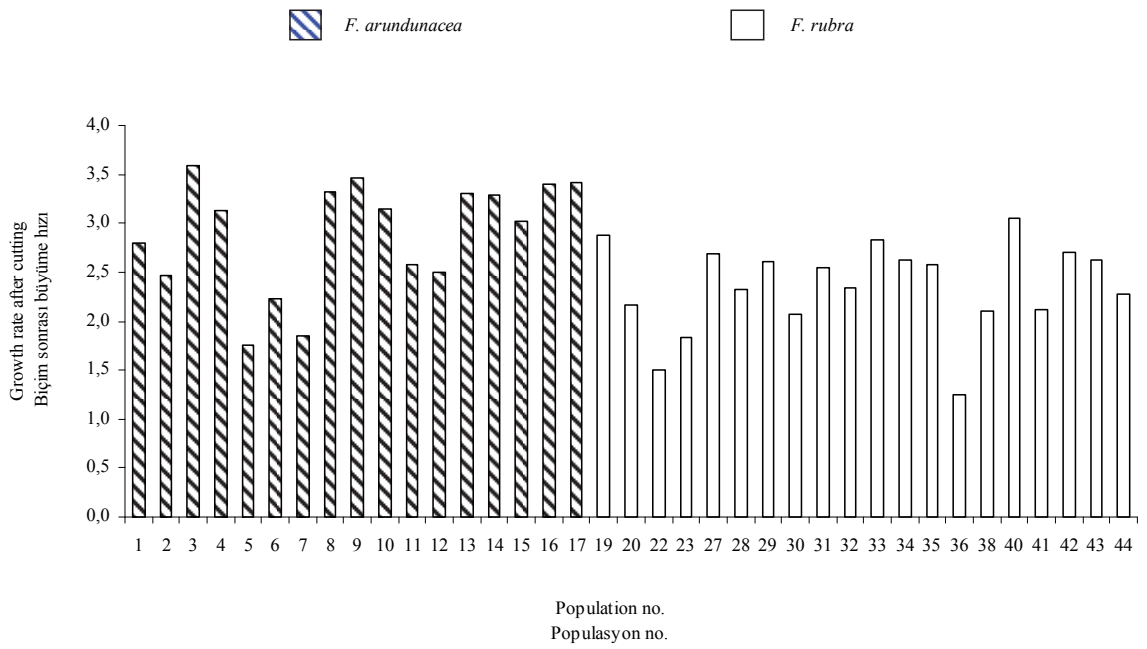

Figure 8. Growth rates of *Festuca* populations after cutting.
Şekil 8. Biçim sonrası yumak populasyonlarının büyüme oranları.

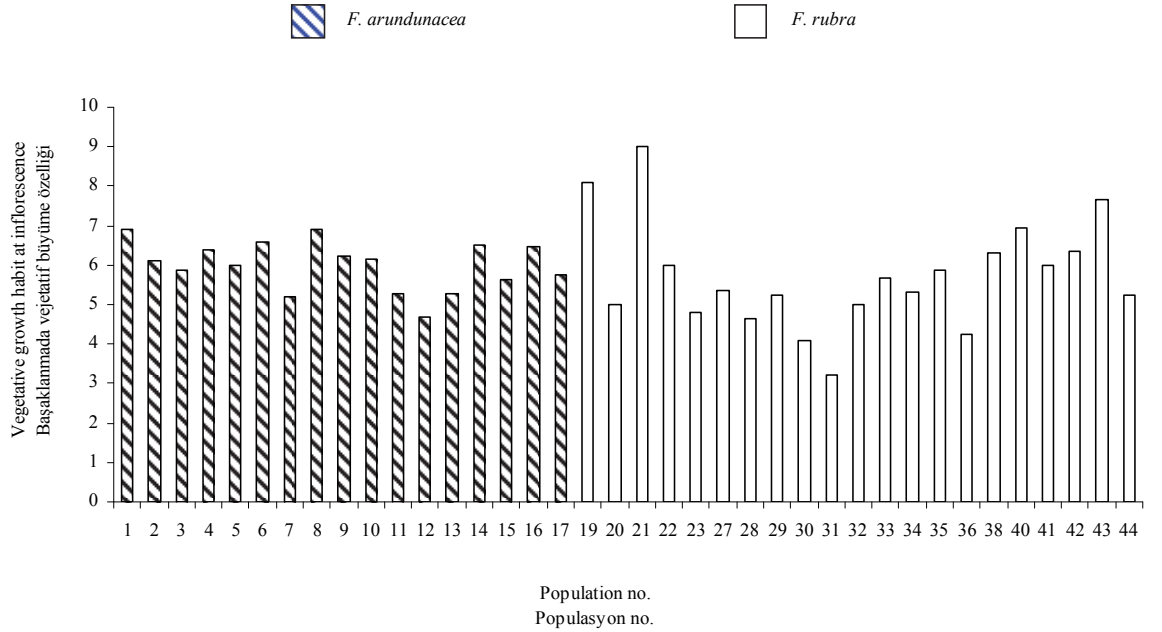

Figure 9. Vegetative growth habit at inflorescence of *Festuca* populations.
Şekil 9. Yumak populasyonlarının başaklanmada vejetatif büyüme alışkanlıkları.

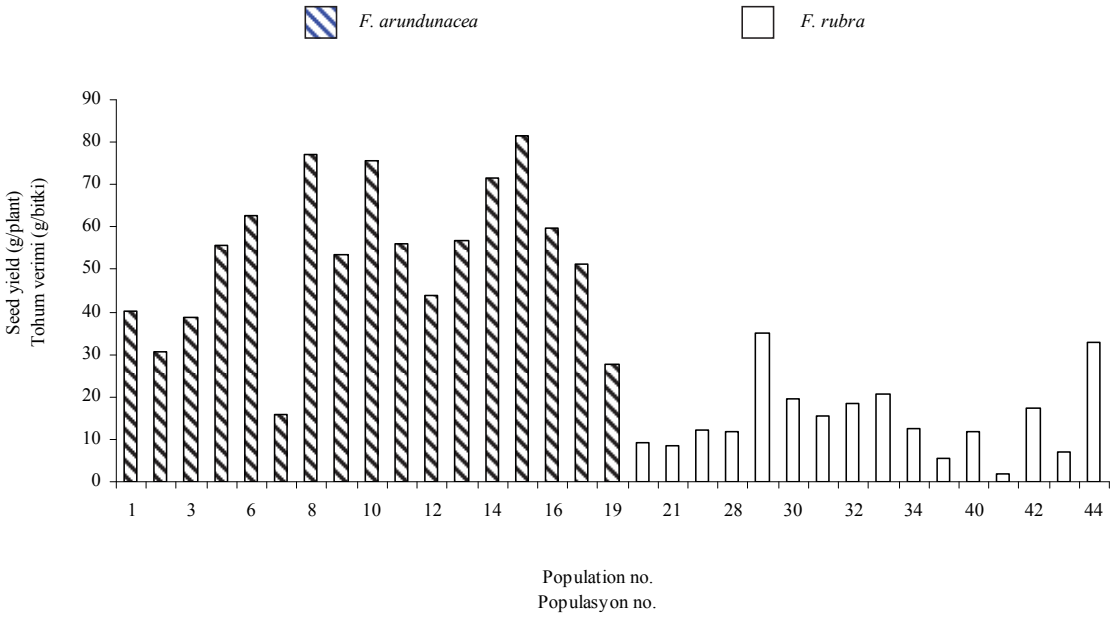

Figure 10. Seed yields of *Festuca* populations.
Şekil 10. Yumak populasyonlarının tohum verimleri.

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