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Determination of Yield and Botanical Composition of the Meadow and Grassland in Çolpan Village at the Shores of Lake Van

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A R T I C L E I N F O	A B S T R A C T
	This study was carried out at the meadows and pastures in Çolpan village of Van province in 2020. In the study, matter yield, botanical composition, plant covered area, rate of decreaser/increaser/invader species were determined. The Loop method was used to determine the botanical composition. In grassland area were identified 69 species belonging to 17 families. In meadow area were identified 20 species belonging to 6 families. The amount of *Poaceae, Fabaceae* and other families found in the grassland area were determined as 18.66%, 15.65%, and 65.69%, respectively. In the meadow area, the amount of *Poaceae, Fabaceae* and other families were determined as 67.50%, 15.0%, and 17.50%, respectively. *Artemisia spicigera (4.74%) Taeniatherum caput-medusae (5.0%) Arenaria serpyllifolia (5.0%) Medicago monantha (5.92%)* species were the most common species found in the grassland area. *Hordeum brevisubulatum* (25.5%), *Bromus scoparius* (16.75%), and *Taraxacum androssovii* (9.25%) species were the most common species found in the meadow area. According to the ratio of good plants, pasture was classified as poor pasture and meadow was in the moderate meadow class. Grassland and meadow matter yields were found to be 91.4 kg/da and 385.2 kg/da, respectively. In the grassland of Çolpan village, invader species were found to be dense. It was concluded that grassland area should be improved.

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Introduction

Quality roughage shortage is still one of the most important problem of animal husbandry of Turkey (Sayar et al., 2010; Başbag et al., 2015). Meadows and grasslands are the cheapest source of quality roughage because they do not require any planting or care in general and they contain cheap and various types of plants (Bakır, 1987; Açıkgöz, 2001). There are 14.6 million hectares of grassland and 1.45 million hectares of meadow in Turkey (Topçu Demiroğlu and Özkan, 2017). Although the total dry matter produced and the feed quality of these meadows is always lower than the conventional feed crops obtained from monoculture or grass-legume mixtures (Tallowin and Jefferson, 1999; Sturludóttir et al., 2013), these offer benefits to overcome future agricultural challenges that go beyond the animal performance level (Hammond et al, 2014; Reiné et al., 2020). In the Eastern Anatolian Region, grasslands are grazed with animals from spring to autumn, while meadows are usually mown once in July and after mowing, they are grazed with animals, and these generally wet areas are compacted by animals (Manga, 1975). Most

of the grasslands are located in arid and semi-arid climatic zones. Van province has 1.239.289 ha of grassland area and 119.733 ha of meadow area (Turan and Altuner, 2014). Failure to comply with management rules of low rainfall is one of the most important reasons for the degradation of vegetation in grasslands (Holechek et al., 2004).

Grazing pressure on meadows and grasslands, which are an indispensable element of economic animal husbandry, is increaser in parallel with the needs of the increaser population. This pressure on grasslands and early grazing brought about a decrease in yield (Sayar et al., 2015). However, the increaser need for shelter of the increaser population is also destroyed by the new roads and agricultural areas built. Grasslands are natural resources that can be used for a long time and renew themselves if grassland management rules are abided. However, if these rules are not abided, they turn into inefficient and barren fields in a very short time (Bilgen and Özyiğit, 2005). Our country's grasslands are in a position to negatively affect our livestock breeding, and therefore the country's

economy (Çınar et al., 2014). The quality of the grassland decreases as a result of the decrease in good breed plants in the grasslands under heavy grazing pressure and the settlement of animal species that do not graze. As the excessive and irregular use of grassland continues, harmful plant species with low quality and weed characteristics settle over time instead of the climax plant species in the vegetation. Some of the invader species that are described as weed cause injuries with their thorns, and some of them adversely affect the quality and quantity of animal products with the toxic substances they contain and sometimes cause animal deaths (Balabanlı et al., 2006). Studies have reported that good-breed plants decrease in vegetation due to the pressure on the grasslands and invader species increase (Koç and Gökkuş, 1994; Çınar et al., 2014; Sayar et al., 2015). Grasslands, which are of great importance in terms of natural balance, have lost their productivity to a large extent due to the effect of grazing in the early or late periods above their capacity (Çomaklı et al., 2012). The botanical composition must be known in order for grassland improvement or management studies to be planned and to succeed (Babalık and Kılıç, 2015; Seydoşoğlu et al., 2015). This study was conducted in order to determine the botanical composition of the meadows and grasslands in Çolpan village at the shore of Lake Van.

Materials and Methods

The study was carried out in meadows and grasslands in Çolpan village in the vegetation period of 2020, within the borders of Tuşba district of Van province. The grassland area of Çolpan village is 5.482 da, the fodder plantation area is 1.175 da, the number of sheep and goats is 152, and the number of bovine animals is 525 (Anonymous, 2017). Located by Lake Van, the village is 1.716 meters above sea level. The study area consists of 12 ha of meadow and 82 ha of grassland area located near the settlement of the village (Figure 1,2,3). In the other

grassland area of Çolpan village, the study could not be carried out as it was not possible to identify plants in grassland under heavy grazing pressure. The meadow where the study was conducted is a natural meadow, which is mown, and grazed after mowing.

The amount of precipitation in the province of Van for the year 2020 was recorded as 377.3 mm, which is close to the long-term average (387.9 mm). The average temperature and relative humidity for the long term are 9.18ºC and 57.93%, and 9.32ºC and 55.84% for 2020. It receives the most rainfall in March, April, and May (Anonymous, 2020).

The area covered with plants, botanical composition, forage yield and condition of grassland and meadow were investigated in this study. The Loop method was used to determine the botanical composition. For this reason, 4 Loop direction were conducted in the grassland area and 2 Loop direction in the meadow area. Size of each direction consisted of 100 measurements. Measurements were made in each direction at every other 20 cm on a 20 m line extending in 4 directions from a point considered as the center of each Loop. In total, 400 measurements were made in each Loop. The dominant species in the measurement was recorded, the number of species found in each loop was divided by the number of measurements, and the ratio of the plant covered area was obtained. The ratio of the species in the composition was calculated over the area covered with plants. In identifying the plant species encountered in the vegetation's greatly benefited from Davis (1978) and Serin et al. (2008). The decreaser, increaser, and invader species, which express the plant species' palatability and their responses to grazing, have been defined by "Turkey's Meadow and Grassland Plants" (Serin et al., 2008). In order to determine the herbage yield, samples were taken from the area within a 50×50 cm frame from 6 points representing the meadow and grassland. The samples were dried in a drying cabinet at 70ºC for 48 hours and the rate of dry matter was calculated.

Figure 1. Place of study area (Google earth)

Figure 2. Images from the meadow area

Figure 3. Images from the grassland area

Results and Discussion

Area Covered with Plant

The study results revealed that the meadow area was covered with plants 100%. The area covered with vegetation in the examined part of the grassland of Çolpan village was determined as 86%. Çınar et al. (2014), reported that the area covered with plants in five different grasslands is between 84.4-99.0%, and in a different study, Çınar et al. (2014) reported that the average rate was 95.3%. Çaçan and Başbağ (2016) reported that the area covered with plants is an average of 68.19%, and it varies between 48.25-86.67% according to years, directions, and altitudes.

Ünal et al. (2012) reported that the area covered with plants may differ according to the use of grassland, and also different results may be obtained with the effect of grazing pressure and vegetation measurement methods.

Botanical Composition

Poaceae, Astereceae, and *Fabaceae* families had the highest density in the grassland area and *Cuscutaceae, Dipsacaceae,* and *Hypericaceae* had the the lowest. Similarly; many researchers reported that *Fabaceae, Asteraceae*, and *Poaceae* families were more found in natural meadow and grasslands of the Turkey than other plant families (Beyiş and Sabancı, 2011; Çaçan et al. 2014; Babalık and Sarıkaya, 2015; Şahin et al. 2015; Çınar et al., 2018; Çınar et al., 2019).

In the grassland area were identified 69 species belonging to 17 families. Total of 37 species in the grassland were perennial (45.29%), two are annual, biennial, or perennial (0.26%), 27 were annual (47.61%), and 3 were biennial (6.84%). (Table 1, Figure 4). It has been reported that perennial species were more common in different grasslands of our country (Çınar et al. 2019; Ertuş and Pınar, 2019). Aydın et al. (2014) reported that the annual species were more common in the grassland area. *Artemisia spicigera (4.74%) Taeniatherum caput-medusae (5.0%) Arenaria serpyllifolia (5.0%) Medicago monantha (5.92%)* species were the most common species found in the grassland area.

In the meadow area were identified 21 species belonging to 6 families. Total of 6 species in the meadow were identified as annual (20.75%), 1 as biennial (1.0%), 12 as perennial (76.50%), 1 as annual or biennial (1.75%). In the area where *Poaceae* family (67.50%) is very dense, species from *Fabaceae* and *Asteraceae* families have also been seen in a significant proportion. On the basis of species, the most frequent were *Hordeum brevisubulatum* (25.5%), *Bromus scoparius* (16.75%), *Taraxacum androssovii* (9.25%) and at least frequent were *Achillea millefolium* (1%), *Medicago rigidula* (1.0%), *Silene conica* (1%) (Table 2, Figure 4). In meadow vegetation, as in grassland vegetation, the rate of perennial species were found to be higher.

1217

Table 1. Botanical Composition and Some Features of Çolpan Village Grassland

Family	Genus-Species	DEC	INC	INV	PPC	Form*
Apiaceae	*Eryngium billardierei*			+	1.32	P
	Grammosciadium daucoides			+	0.92	P
	Pimpinella tragium			+	0.79	P
	Prangos ferulacea			+	1.05	P
Asteraceae	*Achillea arabica*			+	0.67	P
	Artemisia spicigera			+	4.74	P
	Cnicus benedictus			+	0.26	A
	Cota wiedemanniana			+	2.50	A
	Cousinia urumiensis			+	2.11	P
	Cymbolaena griffithii			+	0.79	A
	Lactuca scarioloides			+	0.26	B
	Senecio vernalis			+	1.84	A
	Tanacetum polycephalum			+	0.92	P
	Xeranthemum annuum			+	1.84	A
Boraginaceae	*Alkanna orientalis*			+	0.79	P
	Onosma isaurica			+	0.26	P
	Rindera lanata			+	1.18	P
	Rochelia disperma			+	0.13	A
Brassicaceae	*Alyssum desertorum*			+	1.97	A
	Alyssum szovitsianum			+	2.89	A
	Lepidium draba			+	0.67	P
	Erysimum uncinatifolium			+	3.82	B
	Sisymbrium altissimum			+	0.39	A
Caryophyllaceae	*Arenaria blepharophylla*		+		2.37	P
	Arenaria serpyllifolia			+	5.00	A
	Dianthus orientalis			+	0.26	P
	Gypsophila ruscifolia		+		0.67	P
	Silene argentea			+	0.79	P
	Velezia rigida			+	0.79	A
Chenopodiaceae	*Bassia prostrata*			+	0.53	P
	Salsola boissieri			+	0.39	A
Cistaceae	*Helianthemum ledifolium*			+	4.34	A
Cuscutaceae	*Cuscuta approximata*			+	0.13	A&P
Cyperaceae	*Carex stenophylla*			+	2.24	P
Dipsacaceae	*Scabiosa argentea* L.			+	0.13	B&P
Euphorbiaceae	*Euphorbia heteradena*			+	0.67	P
	Euphorbia esula			+	0.53	P
Fabaceae	*Astragalus aduncus*			+	0.13	P
	Astragalus cancellatus			+	2.89	P
	Medicago monantha			+	5.92	A
	Medicago rigidula			+	3.95	A
	Medicago sativa	+			1.18	P
	Trifolium arvense			+	0.79	A
	Trifolium hirtum			+	0.79	A
Geraniaceae	*Erodium cicutarium*			+	1.45	A
Hypericaceae	*Hypericum scabrum*			+	0.39	P
Lamiaceae	*Clinopodium graveolens*			+	1.05	A
	Salvia frigida			+	1.05	P
	Salvia multicaulis			+	1.45	P
	Salvia syriaca			+	0.26	P
	Sideritis montana			+	0.39	A
	Teucrium chamaedrys			+	0.26	P
	Teucrium polium		+		0.92	P
	Thymus kotschyanus			+	2.50	P
Plumbaginaceae	*Acantholimon caryophyllaceum*			+	2.24	P
Poaceae	*Bromus danthoniae*			+	0.92	A
	Bromus erectus	+			0.26	P
	Bromus japonicus			+	0.26	A
	Bromus tectorum			+	1.97	A
	Dactylis glomerata	+			1.05	P
	Elymus hispidus	+			1.18	P
	Eremopoa persica			+	1.18	A
	Gaudiniopsis macra			+	0.26	A
	Hordeum marinum			+	0.53	A
	Koeleria cristata	+			1.18	P
	Poa bulbosa		+		4.08	P
	Stipa holosericea		+		0.79	P
	Taeniatherum caput-medusae			+	5.00	A
Santalaceae	*Thesium billardieri*			+	2.76	B
Total					100	

*A: Annual, B: Biennial, P: Perennial, DEC: Decreaser, INC: Increaser, INV: Invader, PPC: Percentage of Plant Coverage
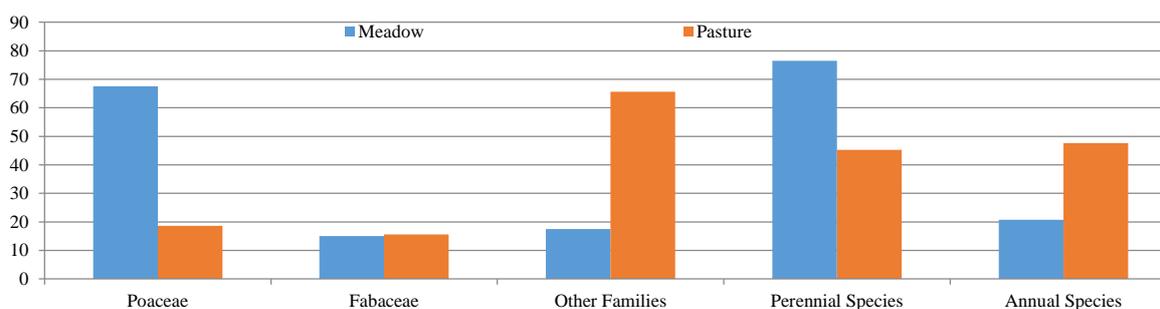
Figure 4. Botanical composition of meadow and grassland (%)

Table 2. Botanical Composition and Some Features of Çolpan Village Meadow Area

Family	Genus-Species	DEC	INC	INV	PPC	Form*
Asteraceae	*Achillea millefolium*			+	2.00	P
	Scorzonera cana			+	1.25	P
	Taraxacum androssovii			+	9.25	P
	Tragopogon porrifolius			+	1.00	B
Caryophyllaceae	*Silene conica*			+	1.00	A
Cyperaceae	*Carex melanostachya*			+	3.00	P
Fabaceae	*Lotus corniculatus*	+			4.50	P
	Medicago lupulina		+		1.00	P
	Medicago rigidula			+	1.00	A
	Medicago varia	+			1.75	P
	Trifolium ambiguum	+			2.50	P
	Trifolium resupinatum			+	2.50	A
	Vicia villosa			+	1.75	A&B
Poaceae	*Bromus scoparius*			+	16.25	A
	Elymus hispidus	+			1.75	P
	Hordeum brevisubulatum		+		25.5	P
	Lolium perenne			+	13.5	P
	Phalaris aquatica	+			3.75	P
	Poa bulbosa		+		3.00	P
	Poa langifolia	+			2.00	P
Ranunculaceae	*Ranunculus damascenus*			+	1.75	P
Total					100.0	

*A: Annual, B: Biennial, P: Perennial, DEC: Decreaser, INC: Increaser, INV: Invader, PPC: Percentage of Plant Coverage

Forage Yield and Condition of Meadow and Grassland

Dry matter yield in the grassland area was found to be between 68.73-106.9 kg/da and 91.40 kg/da on average. This is compatible with the findings of Ertuş et al. (2018), which were higher than the findings of Buzuk et al. (2009) and Çiplak (2015) working at the grasslands in Van. The dry matter yield of the meadow area was found to be between 331.6- 452.9 kg/da and 385.2 kg/da on average. The dry matter yield in the meadows of the Kars region was reported to be between 196.0-250.0 kg/da (Arslan and Tufan, 2011),

The coverage rate of grasses, legumes, and other families of plants in the grassland area were found to be 18.66%, 15.65%, and 65.69% respectively. Çaçan et al. (2014) found the ratio of plants from other families (43.14%) in Bingöl grasslands higher than the ratios of grasses (29.77%) and legumes (27.08%), which were close to each other. Altın et al. (2010) reported that in the barren grassland area of Tekirdağ, grasses take more place in the botanical composition. Terzioğlu and Yalvaç (2004), in the Atmaca and Döneç villages in Van and Bakoğlu and Koç (2002) in Erzurum conditions reported that the proportion of grasses is higher than that of legumes and other families. On the grassland of Onağıl village in Van, Ertuş et al. (2018) reported that the rate of grasses is 45.37%, legume is 9.97%, and other family species is 44.66%. Bakoğlu et al. (2019), working at Handüzü plateau in Rize, reported that it consists of 33.37% grasses, 5.75% legumes, and 60.88% plants from other families. Findings were generally compatible with Çaçan et al. (2014). It is not compatible with other studies, the grazing pressure on the grassland, grassland management style such as grazing animal species and the fact that the research areas have ecologies cause decrease in some plant species in vegetation or the spread of some species.

The ratio of grasses, legumes, and other families in the meadow area was found to be 62.75%, 19.0%, and 18.25%, respectively. Temel et al. (2016), in their study on arid meadows with different soil characteristics, found that other family species were more dense than grasses. The difference in the findings is due to the different ecologies of the study areas.

In the botanical composition of the grassland area, the decreaser, increaser, and invader species were found to be 4.85%, 8.69%, and 86.46%, respectively. In the grassland, the prominent decreaser species were found to be *Medicago sativa, Elymus hispidus, Koeleria cristata* with 1.18%, the increaser were *Poa bulbosa* (%4.08) and *Arenaria blepharophylla* (%2.37), and the invader were *Medicago monantha* (%5.92), *Arenaria serpyllifolia*

(%5.00), *Taeniatherum caput-medusae* (%5.00) and *Artemisia spicigera* (%4.74). In terms of decreaser/increaser/invader plant species, it has great similarities to Ünal et al. (2012) and Ertuş et al. (2018). In the meadow area, on the other hand, the rate of decreaser, increaser, and invader species were found to be 16.25%, 29.5%, and 54.25%, respectively.

It has been found that the rate of good species plants in meadow is moderate and in grassland areas is low. According to the ratio of good plants, pasture was classified as poor pasture and meadow was as moderate meadow class. In our country's grasslands, invader plant species are also reported to be more than good genus plant species by Koç and Gökkuş (1994), Buzuk et al. (2009), Beyiş and Sabancı (2011), Aydın et al. (2014), Çınar et al. (2014), Seydoşoğlu et al. (2015), İspirli et al. (2016), Palta and Genç Lermi (2018) and Ertuş and Pınar (2019).

Conclusion

The species in the meadows and grasslands in Çolpan village at the shores of Van Lake were attempted to be identified and the state of the meadows and grasslands were attempted to be determined by taking decreaser, increaser, and invader species and the yield. The dry matter yield of the grassland was found to be 91.40 kg/da and the dry matter yield of the meadow area to be 385.2 kg/da. The ratio of grasses was seen to be 62.75% and 18.66% in meadows and grasslands, respectively. It has been found that the ratio of good breed plants in grassland is in the weak grassland class with 13.67%. In the meadow area, there were 45.75% good genus plant species. It was determined that the pasture was in the weak class and the meadow was in the moderate class. Meadows are mainly harvested. However, it should be taken into account that good genus species will be exposed to more grazing pressure as they are grazed with animals after the harvest. Therefore, it is important to avoid heavy grazing in the meadow area. As for the grassland area, improvement activities are recommended.

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