

**P 10. THE IMPORTANCE OF FORAGE KOCHIA (*Kochia prostrata* (L) Schrad) IN  
RANGELAND IMPROVEMENT AND THE RESEARCHES CARRIED OUT IN KONYA  
CONDITIONS RELATED TO FORAGE KOCHIA**

Nur Koç<sup>1</sup>, Ramazan Acar<sup>1</sup>

<sup>1</sup>*Selçuk University, Engineering Faculty, Environmental Engineering Department, Konya, Turkey*

*E-mail: racar@selcuk.edu.tr, nurkoc@selcuk.edu.tr*

**ABSTRACT:** Forage kochia (*Kochia prostrata* (L) Schrad Syn. *Bassia prostrata*) belonging *Chenopodiaceae* family is a perennial semi-evergreen sub-shrub species. This species which grows naturally in Turkey's rangelands is tolerance to drought, cold and salinity. Moreover, forage kochia remains green during dry fodder period, and cattle, sheep and goat graze gladly on the forage. While this species green fodder has got 13-18% crude protein, the crude protein ratio in dry matter in hay is between 9% and 11%. In a research carried out in Konya was determined as crude protein 17% DM, NDF 43% and ADF 32%. Immigrant and Snowstorm forage kochia varieties have 1500-2500 kg ha<sup>-1</sup> hay yield. However; in the search carried out, Konya was stated that the populations belong the Konya province had got 1070- 2580 kg ha<sup>-1</sup> hay yield. Forage kochia is used in drought and salty rangelands improvement in the world. In our country, forage kochia have a high potential for economic yield obtain from rangelands having salinity and drought problems in KOP region. For this reason, the practices to rangeland improvement with forage kochia are started, especially in Konya. This review's target is awareness arising from the importance of forage kochia by stating researches carried out and work in progress in Konya Selcuk University related to forage kochia.

*Keywords: Bassia prostrata, Forage Kochia, Hay Yield, Rangeland Improvement*

**1. THE IMPORTANCE OF FORAGE KOCHIA (*Kochia prostrata* (L) Schrad)**

The perennial semi-evergreen shrub forage kochia (*Kochia prostrata* (L.) Schrad Syn. *Bassia prostrata*), has been considered one of the best-suited forage crops for KOP region. Forage kochia has got importance about prevention and control of wind erosion and wildfire in arid or semiarid areas, in addition to, soil conservation in salt-affected soil and dry land. Its various biological properties such as, naturally occurring in the Central Anatolian Region, high salt tolerance, cold and drought tolerance, and its promotion of bio-diversity and ground cover, have a vital role in rangeland improvement. Moreover, forage kochia remains green during dry fodder period, and cattle, sheep, and goat graze gladly on the forage (Acar 2013).

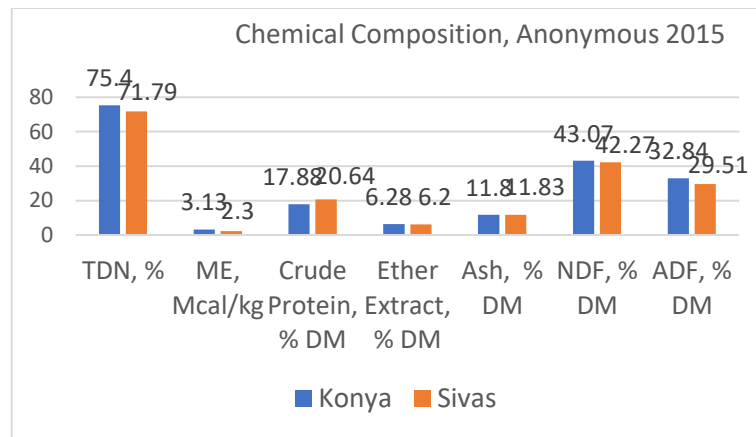
The *Kochia* genus, which belongs to the *Chenopodiaceae* family, have demonstrated a wide variation in terms of morphology. There are different ecotype of forage kochia, and these properties produce to the difference in morphology (i.e., plant height, stem color, canopy, and leaf dimension), vegetation period, and soil adaptation capability (Kitchen and Monsen 2008). Forage kochia have a root system dig down deep up to 6.5 m. The plant height of forage kochia is between 30 and 80 cm (Tilley et al. 2012, Acar 2013, Acar and Koç 2019). It is stated that Forage kochia is more a decumbent plant than other *Bassia* species, and it has got varying stem color (i.e., green, yellow, orange, red and purple). The leaf height of forage kochia is 4-30 mm, and the leaf weight is between 1.0 and 1.5 mm (Safiallah et al. 2017). The morphology of *Bassia* species is effected from climate and environmental conditions. This genus is decreased to their leaf surface and is an increase in leaf hairiness in adaptation to environmental conditions (Safiallah et al. 2017). Forage kochia is occurred to wind-pollinated, and the anther and stigma in the flower of forage kochia have a yellow and red color (Creech 2012, Guo et al. 2014, Acar et al. 2016).

Two forage kochia varieties (i.e., Immigrant and Snowstorm) sold commercially in the world, and these varieties are used in drought and salty rangelands improvement in the world (Tilley et al. 2012). In our country, forage kochia have a high potential for economic yield obtain from rangelands having salinity and drought problems in KOP region. For this reason, the practices to rangeland improvement with forage kochia are started, especially in Konya. This review's target is awareness arising from the

importance of forage kochia by stating researches carried out and work in progress in Konya Selcuk University related to forage kochia.

**2.FEED VALUE OF THE RESEARCHES CARRIED OUT AND CONTINUOUS IN KONYA**

Green fodder of forage kochia has got 13-18% crude protein; the crude protein ratio in dry forage is between 9% and 11% (El Shereef 2016). In a research carried out in Konya was determined as crude protein 17% DM, NDF 43% and ADF 32% in grown Konya condition (Figure 1). However, forage kochia grown in Sivas condition was determined that crude protein was 20.64% DM, NDF was 42, 27% DM and ADF was 29, 51% DM. According to this search, it was stated that forage kochia grown in Konya could be more digestible than grown in Sivas (Anonymous 2015). There are in progress to researches related to the feed value of different types of forage kochia (Figure 2).



**Figure 1.** Feed value of the researches carried out and Konya (Anonymous 2015)



**Figure 2.** The Studies of Feed Value in Different Times- Start in 2018

**3. MORPHOLOGICAL PROPERTIES OF THE RESEARCHES CARRIED OUT AND CONTINUOUS IN KONYA**

Immigrant and Snowstorm forage kochia varieties have 1500-2500 kg ha<sup>-1</sup> hay yield (Waldron et al. 2013). However; in the search carried out Konya was stated that the populations belong the Konya province had got 1070- 4090 kg ha<sup>-1</sup> hay yield (Acar 2013, Acar et al. 2016, Acar and Koç, 2019).

**Table 1.** The Morphological properties of two different kinds of research carried out in Selçuklu and Karatay of Konya's cities having different soil types (Derived from Acar et al. 2016, Acar and Koç 2019)

	Selcuk University Faculty of Agriculture - Selçuklu (Acar and Koç 2019)			Bahri Dağdaş International Agricultural Research Institute - Karatay (Acar et al. 2016)		
	Red Form	Intermediate Form	Green Form	Red Form	Intermediate Form	Green Form
<b>Plant Height (cm)</b>	78,67	81,33	65,33	88,30	84,50	83,70
<b>Plant Diameter (cm)</b>	115,33	121,00	95,00	64,30	86,30	99,00
<b>Hay yield per Plant (g plant<sup>-1</sup>)</b>	235,40	168,87	117,73	142,60	368,60	172,00
<b>Hay Yield (kg ha<sup>-1</sup>)</b>	2589,7	1858,0	1295,0	1580,5	4090,0	1910,1
<b>Seed Yield per Plant (g plant<sup>-1</sup>)</b>	16,96	16,39	19,63	21,80	24,30	15,30
<b>Seed Yield (kg ha<sup>-1</sup>)</b>	186,6	180,3	216,0	240,2	270,0	160,7
<b>1000 seed Weight (g)</b>	2,84	2,66	2,43	2,33	2,35	2,30

In Selçuklu was prominence to red form (i.e., 2589.7 kg ha<sup>-1</sup>) in terms of hay yield when the values at two different kinds of research carried out in Selçuklu (Acar and Koç 2019) and Karatay (Acar et al. 2016) of Konya's cities having different soil types was compared (Table 1). However, In Karatay was determined that intermediate form had higher hay yield (i.e., 4090 kg ha<sup>-1</sup>) than other phenotypes. In these studies could be comprehensible that in the yield properties of varying forage kochia population, different time of life and grown in several soil types could be shown in variation. There are in progress to Ph.D. thesis related to the morphologic variance of the forage kochia population grown in artificial pasture having drought and salinity problems in Konya (Figure 3).



**Figure 3.** The Searches Belongs to Rangeland Improvement with Forage Kochia- start in 2017 (Ph.D. thesis)

Other Researches in Progress: Also, there are in progress to the research of rooting with hormone and seed viability of forage kochia (Figure 4).



**Figure 4.** The Research of Rooting with Hormone - start in 2018 (L) and The Studies of Seed Viability-begin in 2018 (R).

#### 4. CONCLUSION

It can be stated that the difference in the chemical composition of forage kochia grown in a different region of Turkey is less seen than the variation between morphological properties of this species grown in a different location in Konya. We think that it could create awareness about forage kochia which is important shrub forage crops in soil protect, and to improve on rangeland yields in drought conditions in Turkey, and researches continuity related to this species is vitally important in terms of Turkish Agriculture.

#### REFERENCES

- Acar, R. 2013. KOP Doğal Alanlarında Bulunan Bozkır Otu (*Kochia prostrata* (L.) Schrad.) Bitkisinin Önemi ve Mera Islahında Kullanımının Avantajları, I. KOP Bölgesel Kalkınma Sempozyumu Bildiri Kitabı, 14-16 Kasım 2013 Konya, Türkiye.
- Acar, R., Ozkose, A., Isik, S., Acar, B. 2016. Yield Performance of Forage Kochia with Different Stem Color under Water Shortage Konya Province of Turkey, International Journal of Agriculture and Economic Development, 4(1), 21-26.
- Acar, R., Koç, N. 2019. The Determination of Yield and Some Yield Components of Different Forage Kochia (*Kochia prostrata* (L.) Schrad.) Phenotypes Collected and Grown From Natural Areas. Fresenius Environmental Bulletin. 28 (2A), 1429-1433.
- Anonymous, 2015. The Feed Value of Forage Kochia (Unpublished Data). Laboratory Analysis Results.
- Creech, C.F. 2012. Effects of Planting Date, Harvest Date, and Environmental Conditions on Germination of Forage Kochia Accessions, Utah State University, U.S.A.
- El Shereef AA, 2016. Kochia plant as potential forage for ruminants under desert conditions. Annu Res Rev Bio, 10, 1-6
- Guo, H.C., Yan, C., Wei, Y. 2014. Study on The Flowering Dynamic, Pollen Viability, and Stigma Receptivity of *Kochia prostrate*, Acta Pratacultuae Sinica, 23(4), 87-93.
- Kitchen, S.G., Monsen, S.B. 2008. Kochia Roth: Kochia, The Woody Plant Seed Manual. Agric. Handbook (No. 727). Editörler: Bonner, F. T.; Karrfalt, R.P. Washington, DC.: US Department of Agriculture, Forest Service.
- Safiallah, S., Hamdi, S.M.M., Grigore, M.N., Sara, J. 2017. Micromorphology and Leaf Ecological Anatomy of *Bassia* Halophyte Species (*Amaranthaceae*) From Iran, Acta Biologica Szegediensis, 61 (1), 85-93.
- Tilley, D., Ogle, D., St. John, L., Waldron, B.L., Harrison, R.D. 2012. Plant Guide For Forage Kochia (*Bassia prostrata*). Aberdeen, Idaho, U.S.A.: USDA-Natural Resources Conservation Service & Aberdeen Plant Materials Center.
- Waldron, B.L., Larson, S.R., Peel, M.D., Jensen, K.B., Mukimov, T.C., Rabbimov, A., ZoBell, D.R., Wang, R.C., Smith, R.C., Harrison, R. D., Davenport, B.W. 2013. "Snowstorm," A New Forage Kochia Cultivar with Improved Stature, Productivity, and Nutritional Content for Enhanced Fall and Winter Grazing, J. Plant Regist. 7(2), 140.