

Bölüm 5

Kuraklığın Bitkisel Üretime Etkilerine Karşı Sulamanın Önemi

Mualla KETEN¹
Hasan DEĞİRMENCİ²

GİRİŞ

Tarım sektörü beslenme açısından stratejik önceliklere sahiptir ^(1;2). Dünyada nüfus artışına bağlı olarak artan gıda talebi, tarımsal ürünlere olan ihtiyacı artırmakta ve tarım işletmelerinin yani tarım sektörünün sürdürülebilirliğini zorunlu kılmaktadır. Tarımsal girdilerden biri olan su, tarımsal üretim için vazgeçilmez bir öneme sahiptir. Tarım ürünleri olduğu için biyolojik yapılar ve tüm biyolojik materyaller suya ihtiyaç duyar. Sulu tarım, verimliliği arttırdığı için insan ihtiyaçlarının karşılanması açısından, önemlidir ⁽³⁾. Dünya tarım arazilerinin % 17'si sulanmaktadır ve dünya tarımsal üretiminin % 40'ı sulu tarımdan elde edilmektedir ⁽⁴⁾. Türkiye'de toplam ekilebilir arazi yaklaşık 28 milyon hektardır. 12.5 milyon hektar alan sulanabilir olmasına rağmen mevcut su potansiyeli ile ekonomik ve teknik olarak sadece 8,5 milyon hektar alan sulanabilmektedir ⁽⁵⁾. Türkiye'de 6,35 milyon hektar alan sulanmakta olup, 2.15 milyon hektar alan için çalışmalar devam etmektedir ⁽⁶⁾. Türkiye topraklarının hemen hemen % 30'unu tarım alanları kaplar ⁽⁷⁾. Bu kadar büyük bir dilime sahip alanda kuraklığın takip edilmesi ve buna bağlı olarak da, sulama yönetiminin yapılması tarımsal üretim için çok önemlidir.

Tarımsal üretim, büyük ölçüde iklime bağımlıdır, antropojenik iklim değişikliğinden ve ekstrem iklim koşullarından olumsuz etkilenir. Tarımsal üretimdeki riskler küresel anlamda birçok bölgede sorun haline gelebilir, temel olarak kuraklık ve sıcak hava dalgalarının verimde aşırı düşüklüğe (kıtık) sebep olması muhtemeldir. Çevresel bozulma, doğal afet riskini doğrudan büyüttüğü için tarımın kırılganlığına katkıda bulunan ana faktörlerden biridir. Tarımsal üretimde sürdürülebilirliğin sağlanabilmesi için başta kuraklık olmak üzere tarımı etkileyen doğal afetlerin daha iyi anlaşılması gerekmektedir ⁽⁸⁾.

¹ Arş. Gör. Dr., Nevşehir Hacı Bektaş Veli Üniversitesi, Mühendislik-Mimarlık Fakültesi/Biyosistem Mühendisliği Bölümü, mketen@nevsehir.edu.tr

² Prof. Dr., Kahramanmaraş Sütçü İmam Üniversitesi, Ziraat Fakültesi/Biyosistem Mühendisliği Bölümü, degirmenci@ksu.edu.tr

KAYNAKLAR

1. Eştürk, Ö., Ören, M. (2014). Türkiye’de Tarım Politikaları ve Gıda Güvencesi. Yüzcüncü Yıl Üniversitesi Tarım Bilimleri Dergisi, 24 (2) , 193-200 . DOI: 10.29133/yyutbd.235933.
2. Pawlak, K. ve Kolodziejczak, M. (2020). The Role of Agriculture in Ensuring Food Security in Developing Countries: Considerations in the Context of the Problem of Sustainable Food Production. Sustainability, 12, 5488 ; doi:10.3390/su12135488.
3. Bayramoğlu, Z., Ağızan, S., Bozdemir, M., Ağızan, K. (2018). Importance of Irrigation in Agricultural Sustainability. Water, Waste and Energy Management. 4. International Congress. 18-20 July.
4. Anonim, 2002. Food and Agricultural Organisation. <http://www.fao.org/3/y6000en/Y6000EN.pdf>.
5. **Güngör, Y., Erözel, Z., Yıldırım, O. (2012). Sulama Kitabı. Ankara Üniversitesi Ziraat Fakültesi. Tarımsal Yapılar ve Sulama Bölümü. Yayın No:1592.s:28.**
6. Anonim (2016). Devlet Su İşleri. DSİ Faaliyet Raporu, <http://www.dsi.gov.tr/stratejik-planlama/faaliyet-raporlari>.
7. Bayar, R. (2018), Arazi Kullanımı Açısından Türkiye’de Tarım Alanlarının Değişimi, Coğrafi Bilimler Dergisi CBD 16 (2), 187- 200.
8. Dalezios, N.R., Gobin, A., Tarquis, A.M. ve Eslamian, S. (2017). Agricultural Drought Indices: Combining Crop, Climate and Soil Factors. Principles of Drought and Water Scarcity. Vol 1. Chapter 5.
9. Stocker, T.F., Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. (2013). IPCC. Climate Change: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Inter governmental Panel on Climate Change.
10. Huang S, Chang J, Huang Q, Chen Y. (2014). Monthly streamflow prediction using modified EMD-based support vector machine. J Hydrol. 511:764–775.
11. Xianfeng, L., Xiufang, Z., Yaozhong, P., vd. (2015). Spatio temporal changes of cold surges in Inner Mongolia between 1960 and 2012. Journal of Geographical Sciences, 25(3): 259–273.
12. Gan, T.Y., Ito M, Hulsmann, S., Qin, X., Lu, X., Liang, S.Y., Rutschman, P., Disse, M., Koivusalo, H. (2016). Possible climate change/variability and human impacts, vulnerability of drought-prone regions, water source and capacity building for Africa. Int Assoc Scient Hydrol Bull. 61(7):1209–1226.
13. Fang W, Huang S, Huang G, Huang Q, Wang H, Wangal L, Zhang Y, Li P, Ma L. (2019). Copulas-based risk analysis for inter-seasonal combinations of wet and dry conditions under a changing climate. Int J Climatol. doi: 10.1002/joc.5929.
14. Dai A, (2011). Drought under global warming: A review. Wiley Interdisciplinary Reviews: Climate Change, 2(1): 45–65.
15. Türkes M. (2010). Klimatoloji ve Meteoroloji. Kriter Yayınevi, İstanbul.
16. Kömüşçü AÜ, Erkan A, Turgu E. (2002). Normalleştirilmiş yağış indeksi metodu ile Türkiye’de kuraklık oluşumunun coğrafik analizi, DMI Genel Müdürlüğü Araştırma ve Bilgi İşlem Dairesi Başkanlığı Yayını, Ankara.
17. Van Loon AF ve Laaha G. (2015). Hydrological drought severity explained by climate and catchment characteristics” Journal of Hydrology, vol. 526, pp. 3–14.
18. Anonim (2013a). American Meteorological Society (AMS), Drought, <https://www2.ametsoc.org/ams/index.cfm/aboutams/amsstatements/statements-of-the-ams-in-force/drought/>.
19. Wilhite DA, Glantz MH. (1985). Understanding the drought phenomenon-the role of definitions, Water International 10: 111–120.
20. Hisdal H, ve Tallaksen LM. (2000). Drought Event Definition. Assessment of the Regional Impact of Droughts in Europe. Technical Report No. 6.
21. Anonim (2006). Understanding and defining drought, National Drought Mitigation Center, <http://drought.unl.edu/whatis/concept.htm>.

22. Mengü GP, Anaç S, Özçakal E. (2010). Kuraklık Yönetim Stratejileri. Ege Üniv. Ziraat Fak. Derg., 2011, 48 (2): 175-18.
23. Guttman NB. (1998). Comparing the Palmer Drought index and the standardized precipitation index. J Am Water Resour Assoc. 34(1):113-121.
24. Heim RR. (2002). A review of twentieth-century drought indices used in the United States. Bulletin of the American Meteorological Society, 83(8): 1149.
25. Shukla S, Wood AW. (2008). Use of a standardized run off index for characterizing hydrologic drought.
26. MoranTejeda E, Ceglar A, Medvedcvikl B, Vicente-Serrano SM, Lopez-Moreno JI, Gonzalez-Hidalgo JC, Revuelto J, Lorenzo-Lacruz J, Camarero J, Pasho E. (2013). Assessing the capability of multi-scale drought data sets to quantify drought severity and to identify drought impacts: an example in the EbroBasin. Int J Climatol. 33(8):1884-1897.
27. Lin Q,Wu Z, Singh VP, Sadeghi SHR, He H, Lu G. (2017). Correlation between hydrological drought, climatic factors, reservoir operation, and vegetation cover in the Xijiang Basin, South China. J of Hydrol. 549:512-524.
28. Peters E, Bier G, Van Lanen HAJ ve Torfs PJJF. (2006). Propagation and spatial distribution of drought in a ground water catchment,” Journal of Hydrology, vol. 321, no. 1-4, pp. 257-275.
29. Tallaksen LM, Hisdal H ve Lanen HAJV. (2009). Space-time modelling of catchment scale drought characteristics. Journal of Hydrology, vol. 375, no. 3-4, pp. 363-372.
30. Peters E, Torfs PJJF, Van Lanen H AJ ve Bier G. (2003). Propagation of drought through groundwater a new approach using linear reservoir theory,” HydrologicalProcesses, vol. 17, no. 15, pp. 3023-3040.
31. Wanders N, Van Lanen HAJ ve Van Loon A F. (2010).“Indicators for drought characterization on a global scale,” WATCH Technical Report 24.
32. Wilhite DA Ed. (2000). Drought: A Global Assessment, Routledge, London, UK.
33. Tallaksen LM ve Lanen HAJ, Van, Eds. (2004). Hydrological Drought: Processes and Estimation Methods for Stream flow and Groundwater, Elsevier, Amsterdam, Netherlands.
34. Wang W, Ertsen MV, Svoboda MD, Hafeez M. (2016). Propagation of Drought: From Meteorological Drought to Agricultural and Hydrological Drought. Hindawi Publishing Corporation Advances in Meteorology Volume 2016, Article ID 6547209, 5 pageshttp://dx.doi.org/10.1155/2016/6547209.
35. Cayan DR, Maurer EP, Dettinger MD, Tyree M, Hayhoe K. (2008). Climate change scenarios for the California region. Climatic Change. 87(S1):21-42.
36. Seager R, Vecchi GA. (2010). Green house warming and the 21st century hydroclimate of southwestern North America. ProcNatAcadSci USA. 107(50):21277-21282.
37. Connell-Buck CR, Medellin-Azuara J, Lund JR, Madani K. (2011). Adapting California’s water system to warm vs. dry climates. Climatic Change. 109(S1):133-149.
38. Tan Sibel. (2005). Sürdürülebilir Tarım. Tarımsal Ekonomi Araştırma Enstitüsü, T.E.A.EBakı. Sayı 5.
39. Atalık A. (2007). Su Sorunu ve Tarımda Sulama Suyu Kullanımı, TMMOB Ziraat Müh. Odası Mühendislik Dergisi, 81.
40. Değirmenci H. (2008). Sulama Yönetimi ve Sorunları. TMMOB 2. Su Politikaları Kongresi, 20-22 Mart, Ankara.
41. Rosegrant MW, Ringler C, Zhu T. (2009). Water for Agriculture: Maintaining Food Security under Growing Scarcity. Annu. Rev. Environ. Resour. 34:205-22.
42. Siebert S, Burke J, Faures JM, Frenken K, Hoogeveen J, Döll P ve Portmann FT. (2010). Groundwater use for irrigation-a global inventory. Hydrol. Earth Syst. Sci., 14, 1863-1880.
43. Kara T, Gürel C. (2013). Farklı Su Derinliklerinin Çeltik Verimine Etkisi. Anadolu Tarım Bilim. Derg., 28(2):82-86.
44. Singh S, KumarRai P, Chau R, Ravi AK, Neilan BA, Asthana RK. (2015). Temporal variations in microcystin-producing cells and microcystin concentrations in two fresh water ponds. Water Research, 69, 131-142.

45. Anonim (2013b). Food and Agricultural Organization of the United Nations (FAO). UN Lays Foundations for More Drought Resilient Societies: Meeting Urges Disaster Risk Reduction Instead of Crisis Management; FAO: Rome, Italy.
46. Xianfeng L, Xiufang L, Yaozhong P, Shuangshuang L, Yanxu L, Yuqi, M. (2016). Agricultural drought monitoring: Progress, challenges, and prospects. *J. Geogr. Sci.* 2016, 26(6): 750-767.
47. Kapluhan E. (2013). Türkiye'de Kuraklık Ve Kuraklığın Tarıma Etkisi. *Marmara Coğrafya Dergisi Sayı: 27, Ocak - 2013, S. 487-510.*
48. Hailiang L, Shengpei D, Hongxia L (2012). Status and prospects of agricultural drought monitoring. *ChinaRuralTechnology*, 5: 46–48.
49. Loon AFV. (2015). Hydrological drought explained. Wiley Periodicals s, Inc.WIREsWater 2015. doi: 10.1002/wat2.1085.
50. Sheffield J, Wood EF (2011). Drought: Past Problem sand Future Scenarios. London and Washington DC: Earthscan.
51. Van Vliet MTH, Yearsley JR, Ludwig F, Vogele S, Lettenmaier DP, Kabat P. (2012). Vulnerability of US and European electricity supply to climate change. *NatClimChange* 2:676–681. doi:10.1038/nclimate1546.
52. Chen H, Zhang H, Liu R vd. (2009). Agricultural drought monitoring, forecasting and loss assessment in China. *Technology Review*, (11): 82–92.
53. Schwalm CR, Williams CA , Schaefer K, Baldocchi D, Black TA, Goldstein AH., Law BE, Oechel WC, Paw UKT ve Scott RL. (2012). Reduction in carbon uptake during turn of the century drought in western North America. *Nature Geoscience*. Published Online: 29 JULY 2012 | DOI: 10.1038/NGEO1529.
54. Zhang Q, Han L, Zhang L ve ark. (2014). Analysis on the character and management strategy of drought disaster and risk under the climatic warming. *Advances in Earth Sciences*, 1: 80–91.
55. Dinar A, Mendelsohn RO. (2011). Handbook on climate change and agriculture. Edward Elgar Publishing, Cheltenham, Gloucestershire, U. K. p:384-389.
56. Zselezky L, Yosef S. (2014). Are shocks really increasing? A selective review of the global frequency, severity, scope, and impact of fivetypes of shocks (Vol. 5). International Food Policy Research Institute, Addis Ababa, Ethiopia.
57. Arab D, Elyasi A, Far HT, Karamouz M. (2010). Developing an integrated drought monitoring system based on socio economic drought in a trans boundary river basin: a case study. World Environmental and Water Resources Congress in Providence, Rhode Island, May 16-20, 2010: Challenges of Change; p. 2754–2761.
58. Chen J, Fu T. 2011. Application of water poverty index to socio economic drought assessment. *Water Resources and Power.* 29(9):130–133.
59. Wada Y, Van Beek LPH, Viviroli D, Durr HH, Weingartner R, Bierkens MF. (2011). Global monthly water stress: 2. Water demand and severity of water stress. *Water Resour Res.* 47, W07518, doi:10.1029/2010WR009792.
60. Madani K. (2014). Water management in Iran: what is causing the loomingcrisis?. *J Environ Stud. Sci.* 4(4):315–328.
61. Sivapalan M. (2015). Debates-Perspectives on socio-hydrology: Changing water systems and the “tyranny of small problems”-Socio-hydrology. *WaterResourRes.* 51(6):4795–4805.
62. Wheeler HS, Gober P. (2015). Water security and the science agenda. *Water Resour Res.* 51(7): 5406–5424.
63. Vogel RM, Lall U, Cai X, Rajagopalan B, Weiskel PK, Hooper RP, Matalas NC. (2015). Hydrology: The interdisciplinary science of water. *Water Resour Res.* 51(6):4409–4430.
64. Montanari A. (2015). Debates–perspectives on socio-hydrology: introduction. *WaterResour-Res.* 51(6):4768–4769.
65. Zhao M, Huang S, Huang Q, Wang H, Leng G, Xie Y. (2019). Assessing socio-economic drought evolution characteristic sand their possible meteorological driving force. *Geomatics, Natural HazardsAnd Risk* 2019, VOL. 10, NO. 1, 1084–1101.

66. Wilhite D. 2007. Preparedness and coping strategies for agricultural drought risk management: recent progress and trends. In: Sivakumar MVK, Motha RP (eds) Managing weather and climate risks in agriculture. Springer, New York, pp 21–38. ISBN 978-3-540-72744-6.
67. Knox JW, Morris J, Hess TM. (2010). Identifying future risks to UK agricultural crop production-putting climate change in context. *Outlook Agr* 39(4):249–256. doi:10.5367/oa.2010.0015.
68. Karl TR, Melillo JM ve Peterson TC. (2009). Global climate change impacts in the United States. Cambridge Univ. Press, Cambridge, UK.
69. Olesen JE, Trnka M, Kersebaum KC, Skjelvag AO, Seguin B, Peltonen-Sainio P, Rossi F, Kozyra ve Micale F. (2011). Impacts of adaptation of European crop production systems to climate change. *Eur. J. Agron.* 34:96–112. doi:10.1016/j.eja.2010.11.003.
70. Agha Kouchak A, Farahmand A, Melton F S ve ark. (2015). Remote sensing of drought: Progress, challenges and opportunities. *Reviews of Geophysics*, 53: 452–480.
71. Mishra A K, Singh V P (2010). A review of drought concepts. *Journal of Hydrology*, 391(1/2): 202–216.
72. Wang G. (2005) “Agricultural drought in a future climate: results from 15 global climate models participating in the IPCC 4th assessment”, *Climate Dynamics*, 25(2005):739–53.
73. Zhang Q, Zhang L, Cui X ve ark. (2011). Progresses and challenges in drought assessment and monitoring. *Advances in Earth Sciences*, 7: 763–778.
74. Wilhite DA, Sivakumar MVK, Pulwarty R. (2014). Managing drought risk in a changing climate: The role of National Drought Policy. *Weather Clim. Extrem.* 3, 4–13.
75. Udmale P, Ichikawa Y, Manandhar S, Ishidaira H, Kiem AS. (2014). Farmers’ perception of drought impacts, local adaptation, and administrative mitigation measures in Maharashtra State, India. *Int. J. Disast. Risk Reduct.* 10, 250–269.
76. Rojas-Downing MM, Nejadhashemi AP, Harrigan T, Woznicki SA. (2017). Climate change and livestock: Impacts, adaptation, and Mitigation. *Clim. Risk Manag.* 16, 145–163.
77. Ray RL, Fares A, Risch E. (2018). Effects of Drought on Crop Production and Cropping Areas in Texas. *Agricultural & Environmental Letters*.
78. Tol RSJ. (2002). “Estimates of the Damage Costs of Climate Change-Part 1: BenchmarkEstimates”, *Environmental and Resource Economics*, 21(2002):47–73.
79. Thiele R. 2003. “Price incentives, Non-Price Factors and Agricultural Production in Sub Saharan Africa: A Cointegration Analysis” presented at the International Association of Agricultural Economists Annual Meeting, Durban, South Africa, August 16-22.
80. Şahin Ü ve Kurnaz L. 2014. İklim değişikliği ve kuraklık. İstanbul politikalar merkezi yayınları.
81. Topçuoğlu K, Mengü GP, Anaç S. 2008. Ege Bölgesi Meteorolojik Kuraklık Analizi. 5. Dünya Su Forumu Türkiye Bölgesel Su Toplantıları-Konya Kapalı Havzası Yeraltı suyu ve Kuraklık Konferansı, 175-184, Konya, Türkiye.
82. Mengü GP, Akkuzu E. 2008. Küresel Su Krizi ve Su Hasadı Teknikleri. ADÜ Ziraat Fakültesi Dergisi. 5(2):75-85.
83. Anglian Water, University of Cambridge (2013) Water, water everywhere? encouraging collaborating and building partnerships. Institute for Sustainable Leadership, University of Cambridge.
84. Hulme M, Jenkins G, Brooks N, Cresswell D, Doherty R, Durman C, Gregory J, Lowe J, Osborn T. (2002) What is happening to global climate and why? In: Health effects of climate change in the UK, Department of Health, London, pp 18–49.
85. Anonim. (2013a). The case for change current and future water availability. Report GEHO1111BVEP-E-E. <http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/geho1111bvpe-e-e.pdf> Accessed 17 May 2016.
86. Kıymaz S, Güneş V, Asar M. (2011). Standartlaştırılmış Yağış İndeksi İle Seyfe Gölünün Kuraklık Dönemlerinin Belirlenmesi. *GOÜ, Ziraat Fakültesi Dergisi*, 28(1), 91- 102 91.
87. Ilgar R. (2010). Çanakkale’de Kuraklık Durumu ve Eğilimlerinin Standartlaştırılmış Yağış İndisi ile Belirlenmesi. *Marmara Coğrafya Dergisi Sayı: 22, S. 183 – 204.*

88. Gümüş V, Başak A, Oruç N. (2016). Standartlaştırılmış Yağış İndeksi (SPI) Yöntemi ile Şanlıurfa İstasyonunun Kuraklık Analizi. H.Ü Müh. Der. 01 (2016) p.36-44.
89. Çaldağ B. (2009). Trakya Bölgesi'nin Tarımsal Meteorolojik Özelliklerinin Belirlenmesi. İ.T.Ü. Fen Bilimleri Enstitüsü, Doktora Tezi. İstanbul
90. Şimşek O. (2010). Türkiye'de Tarım Yılı Kuraklık Değerlendirmesi ve Bitki Gelişim Modeli ile Buğdayda Kuraklık-Verim Analizi. Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Doktora Tezi. S:138.
91. Turan ES. (2018). Türkiye'nin İklim Değişikliğine Bağlı Kuraklık Durumu. Doğal Afetler ve Çevre Dergisi, 4(1), 63-69.
92. Houghton JT, Filho LGM, Callander BAN, Harris, A. Kattenberg, and K. Maskell, Climate Change (1995). The Science of Climate Change, Intergovernmental Panel on Climate Change, pp. 572, Cambridge University Press, Cambridge, GB, 1996.
93. Schimmelpfennig, G. (1996). Uncertainty in Economic Model Climate Change Impacts. Climatic Change, 33(2):213-234.
94. Quan XW, Diaz HF ve Hoerling MP. (2004). Changes in the Tropical Hadley Cell since 1950. The Hadley Circulation: Present, Past, and Future. Advances in Global Change Research 21. 85-120.
95. Frierson DM, Lu WJ ve Chen G. (2007). Width of the Hadley cell in simple and comprehensive general circulation models. Geophysical Research Letters 34: L18804.
96. Seidel DJ, Fu Q, Randel WJ ve Reichler TJ. (2007). Widening of the tropical belt in a changing climate. Nature Geoscience 1: 21-24. GeophysResLett. 35, L02405, doi:10.1029/2007GL032487.
97. Johanson CM ve Fu Q. (2009). Hadley Cell Widening: Model Simulations versus Observations. Journal of Climate 22: 2713-2725.
98. Kurnaz L. (2014). Kuraklık ve Türkiye. İstanbul politikalar merkezi, Mercator Politika Notu.
99. Anonim. (2021). Special Report on Drought 2021. Global Assessment Report on Disaster Risk Reduction. <https://reliefweb.int/sites/reliefweb.int/files/resources/GAR%20Special%20Report%20on%20Drought%202021.pdf>.
100. Türkeş M. ve Erlat E. (2003). Precipitation changes and variability in Turkey linked to the North Atlantic Oscillation during the period 1930- 2000. International Journal of Climatology 23: 1771-1796.
101. Türkeş M ve Erlat E. (2005). Climatological responses of winter precipitation in Turkey to variability of the North Atlantic Oscillation during the period 1930-2001. Theoretical and Applied Climatology 81: 45-69.
102. Türkeş M ve Yıldız D. (2014). Türkiye'de Hidroelektrik Santrallerin Geleceği.
103. Visbeck MH, Hurrell JW, Polvani L ve Cullen HM. (2001). The North Atlantic Oscillation: Past, present, and future. Proc. Natl. Acad. Sci. 98: 12876-12877.
104. Krichak SO, Breitgand JS, Gualdi S ve Feldstein SB. (2013). Teleconnection-extreme precipitation relationships over the Mediterranean region. Theor. Appl. Climatol. DOI 10.1007/s00704-013-1036-4.
105. Faures JM, Svendsen M ve Turrall HN. (2007). Reinventing Irrigation. Ch. 9 Comprehensive Assessment of Water Management in Agriculture. Earthscan. ISBN 978-1-84407-396-2.
106. Reddy SR ve Nayak P. (2018). Crop production with limited irrigation: A review. Agricultural Reviews, 39(1): 12-21.
107. Ghinassi G, Trucchi P. 2001. Deficit irrigation trials on maize in a Mediterranean semi-arid environment. Int. Water Irrig. 21 (1), 12-17.
108. Kirda CR. (2002). Deficit irrigation scheduling based on plant growth stages showing water stress tolerance. In: Deficit Irrigation Practices, FAO Water Reports 22, pp. 3-10.
109. Mao X, Liu M, Wang X, Liu C, Hou Z, Shi J. (2003). Effects of deficit irrigation on yield and water use of greenhouse grown cucumber in the North China Plain. Agric. Water Manage. 61, 219-228.
110. Panda RK, Behera SK, Kashyap PS. (2003). Effective management of irrigation water for wheat under stressed conditions. Agric. Water Manage. 63 (1), 37-56.

Kuraklıđın Bitkisel Üretime Etkilerine Karşı Sulamanın Önemi

111. Zhang J, Yang J. (2004). Improving harvest index is an effective way to increase crop water use efficiency. In: Proceedings of the 4th Int. Crop Sci. Congress, held at Brisbane, September 2004, on the theme "Crop Science for Diversified Planet".
112. Iglesias A, Garrote L, Cancelliere A, Cubillo F, Wilthite D. (2009) Coping with drought risk in agriculture and water supply systems. Springer, pp 322. ISBN: 978-1-4020-9044-8.
113. Iglesias A, Quiroga S, Moneo M, Garrote L. (2012) From climate change impacts to the development of adaptation strategies: challenges for agriculture in Europe. *Clim Change* 112:143–168.