

A REVIEW ON INTEGRATION OF MODERN TECHNOLOGY IN RAINFED AGRICULTURE IN MALAWI

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ABSTRACT

Agriculture is the backbone of the Malawi's economy just as most of the countries in Sub-Saharan Africa. However, its sustenance has been limited to reliance on rainfall, that is Rainfed Agriculture. Despite offering much of cash and food crops, labour and Gross Domestic Product, Rainfed Agriculture is faced by numerous challenges among others the impact of climate change with perceived erratic rainfall. The consequent dry spells have greatly reduced yields, surprisingly modern technological methods are rarely put in place to deal with the challenges regarding Rain Fed Agriculture. There is little effort on capitalising on rain water that may duly fall on the field which can be duly stored and used to ease the dry spells. This Review constitutes 55 published studies and reports from google scholar on Rainfed agriculture highlighting the status of Rainfed agriculture in Malawi and abroad, challenges and resilient measures. Thematic analysis of these studies unearths challenges and resilient measures to rain fed agriculture. This Review observes that the integration of modern agricultural technologies in rain fed agriculture among others supplemental irrigation could be crucial in addressing these challenges.

KEY WORDS: Climate Change, Drought, Rainfed Agriculture, Rainwater Harvesting.

References

- Adhama, A., Riksen, M., Ouessar, M., & Ritsema, C. (2016). Identification of suitable sites for rainwater harvesting structures in arid and semi-arid regions: A Review. *International Soil and Water Conservation Research*, 108-120.
- AgriculturalDevelopmentEconomicsDivision. (2009). The special challenge for Sub-Saharan africa. *How to feed the world 2050*. Rome: FAO.
- Al-Bakri, J., Suleiman, A., Abdulla, F., & Ayad, J. (2010). Potential impact of climate change on Rainfed agriculture of a semi-arid basin in Jordan. *Physics and Chemistry of the Earth*, 125–134.
- Alemaw, B. (2012). Resilience, reliability and risk analyses of maize, sorghum and sunflower in rain-fed systems using a soil moisture modeling approach. *Agricultural Sciences*, 3(1), 114-123. doi:10.4236/as.2012.31015
- Alemaw, B. F., & Simalenga, T. (2015). Climate change impacts and adaptation in Rainfed farming systems: A modeling framework for scaling-out climate smart agriculture in Sub-Saharan Africa. *American Journal of Climate Change*, 313-329.

- Ashalatha, K., Gopinath, M., & Bhat, A. R. (2012). Impact of Climate Change on Rainfed Agriculture in India: A Case Study of Dharwad. *International Journal of Environmental Science and Development*, 3(4), 368-371.
- Asmamaw, D. K. (2014). Conservation tillage implementation under Rainfed agriculture: Implication for soil fertility, green water management, soil loss and grain yield in the Ethiopian Highlands. *International Journal of Agricultural Sciences*, 2(9), 268-280.
- Baig, M. B., Shahid, S. A., & Straquadine, G. S. (2013). Making Rainfed agriculture sustainable through environmental friendly technologies in Pakistan: A Review. *International Soil and Water Conservation Research*, 1(2), 36-52.
- Bauer, P. J., Sadler, E., & Frederick, J. (2003). Rainfed farming. *Encyclopedia of Water Science*, 780-782.
- Chikwezga, G. Y. (2016). Climate change and smallholder farming in Malawi: The way forward. *ABE International Seminar*. University of Tsukuba.
- Cooper, P. J., & Coe, R. (2011). Assessing and addressing climate-induced risk in sub-saharan Rainfed agriculture. *Experimental Agriculture*, 47(2), 179-184. doi:10.1017/S0014479711000019
- Cooper, P., Rao, K., Singh, P., Dimmes, J., Traore, P., K.Rao, . . . Twomolow, S. (2009). Farming with current and future climatic risk: Advancing a Hypothesis of Hope for Rainfed agriculture in the semi arid tropics. *Journal of SAT Agricultural Research* 7.
- Cornelis, W. (2012). Building resilience against drought: The soil-water management perspective. *Royal Academy of Overseas Sciences*. Gent: Ghent University.
- Critchley, W. (2009). *Soil and water management techniques in Rainfed agriculture: State of the art and prospects for the future*. Centre for International Cooperation.
- DeFraiture, C., Karlberg, L., & Rockström, J. (2009). Can Rainfed Agriculture Feed the World? An Assessment of Potentials and Risk. In S. P. Wani, J. Rockström, & T. Oweis, *Rainfed Agriculture: Unlocking potential* (pp. 124-122). Oxfordshire: CAB International.
- Denning, G., Kabambe, P., Sanchez, P., Malik, A., Flor, R., Harawa, R., . . . Sachs, J. (2009). Input subsidies to improve smallholder maize productivity in Malawi: Toward an African green revolution. *PLoS Biology*, 7(1), 2-10.
- Devendra, C. (2016). Rainfed agriculture: Its importance and potential in global food security. *Utar Agriculture Science Journal*, 2(2).
- Dixon, J. L., & Stringer, L. C. (2015). Towards a theoretical grounding of climate resilience assessments for smallholder farming systems in Sub-Saharan Africa. *Resources*, 128-154. doi:10.3390/resources4010128
- Droogers, P., Seckler, D., & Makin, I. (2001). *Estimating the potential of rain-fed agriculture*. Water Management International Institute.
- Fahrudin, M. H., & Mahrup, I. (2017). Study of water management on Rainfed land in downstream Renggung watershed. *Meteorology Hydrology and Water Management*, 5(1), 29-35.
- Foxa, P., & Rockström, J. (2003). Supplemental irrigation for dry-spell. *Agricultural Water Management*, 61(1), 29-50. doi:10.1016/S0378-3774(03)00008-8
- Gautam, R. C., & Rao, J. V. (2017). *Integrated Water Management: Concepts of Rainfed Agriculture*. CRIDA.
- Hansen, J. W. (2010). *Climate Information Provision*. International Research Institute for Climate and Society, Columbia University.
- Innocencia, A., Sally, H., & Mervey, D. (2002). Innovative approaches to agricultural water use for improving food security in Sub-Saharan Africa. *World Summit for Sustainable Development*. South Africa: IWMI.

- International Water Management Institute. (2017). *Solutions for improved water management in West Africa's Smallholder agriculture*. Accra: IWMI.
- IWMI. (2018, January 31). *Rainfed agriculture*. Retrieved from <http://www.iwmi.cgiar.org/issues/Rainfed-agriculture/summary/>
- Jägermeyr, J., Gerten, D., Schaphoff, S., Heinke, J., Lucht, W., & Rockström, J. (2016). Integrated crop water management might sustainably halve the global food gap. *Environmental Research Letters*. doi:10.1088/1748-9326/11/2/025002
- Kariuki, J. G. (2015). *The Future of Agriculture in Africa. The Pardee Papers*. Boston University.
- Khamis, M. (2016). *Climate change and smallholder farmers in Malawi: Understanding poor people's experiences in climate change adaptation*. Action Aid.
- Kijne, J., Barker, R., & Molden, D. (2003). Improving water productivity in the dry areas of West Asia and North Africa. In T. Oweis, & A. Hachum, *Limits and opportunities for improvement* (pp. 179-198). CAB International.
- Koirala, K. H., Mishra, A. K., & Sitienei, I. (2015). Farm productivity and technical efficiency of rural Malawian households: Does gender make a difference. *Southern Agricultural Economics Association's 2015 Annual Meeting*. Atlanta.
- Lal, R. (2009). Managing soil water to improve Rainfed agriculture in India. *Journal of Sustainable Agriculture*, 32(1), 51-75. doi:10.1080/10440040802121395
- Lingling, L., Renzhi, Z., Zhuzhu, L., Weili, L., Junhong, X., Liqun, C., & Bellotti, B. (2014). Evolution of soil and water conservation in rain-fed areas of China. *International Soil and Water Conservation Research*, 2(1), 78-90.
- Makombe, G., Namara, R., Hagos, F., Awulachew, S. B., Ayana, M., & Bossio, D. (2011). A Comparative analysis of the technical efficiency of rain-fed and Smallholder irrigation in Ethiopia. *International Water Management Institute Working Paper 14*. International Water Management Institute.
- Makurira, H. (2010). *Water productivity in Rainfed agriculture: Redrawing the rainbow of water to achieve food security in Rainfed smallholder systems*. Deft: UNESCO Institute for Water Education.
- Mark Rosegrant, X. C. (2002). *The Role of Rainfed Agriculture in the Future of*. Washington: International Food Policy Research Institute.
- Masila, T., Udoto, M. O., & Obara, J. (2015). The influence of soil and water conservation technologies on household food security among Small-Scale farmers in Kyuso Sub-County, Kitui County, Kenya. *Academia Journal of Agricultural Research*, 3(2), 23-28. doi:10.15413/ajar.2015.0101
- Mishra, D. K. (2015). *Production and exchange relations in Rainfed agriculture: The case of rice in Odisha*. Dehli: Centre for the Study of Regional Development.,
- Msoyoya, K., Madani, K., Davtalab, R., Mirchi, A., & Lund, J. R. (2016). Climate change impacts on maize production in the Warm Heart of Africa. *Water Resour Manage*, 5299–5312. doi:DOI 10.1007/s11269-016-1487-3
- Mutekwa, V., Kusangaya, S., & Chikanda, A. (2014). The adoption of rainwater harvesting techniques in Zimbabwe: The case of Chivi ward in Masvingo. *Researchgate*.
- National Investment Profile. (2015). *Water for agriculture and energy*. Lilongwe: FAO.
- Njolomai, H. M., Kita, I., Kitamura, Y., & Aoyagi, S. (2011). Effect of climate change in Rainfed maize production: Assessment of maize production vs. a changing rain pattern in Malawi. *Journal of Rainwater Catchment Systems*, 16(2), 25-37.
- OECD/FAO. (2016). *Agriculture in Sub-Saharan Africa: Prospects and challenges for the next decade in OECD-FAO Agricultural Outlook 2016-202*. Paris: OECD Publishing.

- Oweis, T., & Hachum, A. (2009). Water harvesting for improved Rainfed agriculture in the dry environments. In S. Wani, *Rainfed Agriculture: Unlocking the potential*. Aleppo: CAB International.
- Rockström, J., Hatibu, N., Oweis, T. Y., Wani, S., Barron, J., Bruggeman, A., . . . Qiang, Z. (2007). *Managing water in Rainfed agriculture*. IWMI.
- Rockstrom, J., Karlberg, L., Wani, S. P., Barron, J., Hatibu, N., Oweis, T., . . . Qiang, Z. (2010). Managing water in Rainfed agriculture: The need for a paradigm shift. *Agricultural Water Management* 97, 543-550.
- Russo, T., Alfredo, K., & Fisher, J. (2014). Sustainable water management in urban, agricultural, and natural systems. *Water*, 3934-3956. doi:10.3390/w6123934
- Rutherford, R. (2010). *An assessment of Rainfed crop production potential in south africa's neighbouring countries*. South Africa: Department of Water Affairs.
- Sideriusa, C., Walsuma, P. V., Roesta, C., Smita, A., Hellegersb, P., Kabatd, P., & Vanlerland, E. (2016). The role of Rainfed agriculture in securing food production in the Nile Basin. *Environmental Science and Policy*, 14-23.
- Stevens, T., & Madani, K. (2016). Future climate impacts on maize farming and food security in Malawi. *Scientific Reports*, 6(36241). doi:10.1038/srep36241
- Stone, R., & Potgieter, A. (n.d.). Drought risk and vulnerability in Rainfed agriculture: Example of a case study in Australia. *Series, A(80)*, Mediterranean.
- USAID. (2014, March 7). *Enhancing Rainfed Agriculture*. Retrieved from <https://www.usaid.gov/what-we-do/water-and-sanitation/promoting-water-productivity-and-efficiency/enhancing-Rainfed>
- VanderZaag, P. (2015). *Soil and water management for Rainfed agriculture in semi-arid areas: Securing livelihoods and food production by slowing the water flow in catchment areas*. UNESCO-IHE Institute for Water Education.
- Yosef, B., & Asmamaw, D. (2015). Rainwater harvesting: An option for dryland agriculture in arid and semi arid Ethiopia. *International Journal of Water Resources and environmental engineering*, 7(2), 17-28.
- Zemadim, B. (2016). The challenges of Rainfed agricultural practices in Mali-redefining research agenda: A short communication. *Advances in Plants & Agriculture Research*, 4(1).