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Boubaker Dhehibi
International Center for Agricultural Research in the Dry Areas, Tunisia

Arash Nejatian
International Center for Agricultural Research in the Dry Areas, Dubai

Abdul Aziz Niane
International Center for Agricultural Research in the Dry Areas, Dubai

Azaiez Ouled Belgacem
Food & Agriculture Organization

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Factors Influencing Adoption of Rangeland Rehabilitation Technologies by Agro-pastoralists in the Arabian Peninsula: Evidence from Analysis in Saudi Arabia and Qatar

Boubaker Dhehibi*, Arash Nejatian†, Abdul Aziz Niane‡, Azaiez Ouled Belgacem§

* Social, Economic, and Policy Research Team (SEPRT), International Centre for Agricultural Research in Dry Areas (ICARDA), Tunis-Tunisia. E-mail: b.dhehibi@cgiar.org
† Arabian Peninsula Regional Program, ICARDA, Dubai UAE. E-mail: a.nejatian@cgiar.org
‡ Arabian Peninsula Regional Program, ICARDA, Dubai UAE. E-mail: a.niane@cgiar.org
§ Food & Agriculture Organization of the United Nation (FAO), Riyadh, Saudi Arabia. E-mail: azaiez.ouledbelgacem@fao.org

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Abstract

Rangelands are the main land use in the Arabian Peninsula and cover about 50% of total area. They are under continuous heavy grazing pressure due to underlying social and economic causes as well as institutional effects. ICARDA in collaboration with the National Agricultural Research Systems (NARS) has developed and introduced different rehabilitation techniques including resting, planting native range species and water harvesting in different countries of the AP such as Kuwait, Qatar, Saudi Arabia (KSA) and Yemen. However, the adoption of these techniques by end users was not evaluated. In this context, a research has been conducted in Saudi Arabia and Qatar to determine the factors affecting the speed of adoption and identify the main constraints affecting the adoption level and the dissemination for these rehabilitation techniques with special focus on perceived perceptions of the research and extension (R&E) systems on the impact of the characteristics of these technologies on their adoption level.

To meet these objectives, the Adoption and Diffusion Outcome Prediction Tool (ADOPT) and the Likert-scale approach have been implemented and the qualitative data were gathered through two focus group discussion, respectively. The empirical findings revealed a significant difference between KSA and Qatar on the predicted peak of adoption of this technological package (planting native range species and water harvesting). Although the predicted years to peak such adoption are around 18 years, the peak of adoption is expected to be 92% for KSA and 11% for Qatar. This is mainly due to the fact that this technological package is newly getting adopted in Qatar. This predicted peak remains very low even during the first five and ten years for the case of Qatar. The main factors constraining the adoption of these rehabilitation technologies and therefore its dissemination are the complexity of the innovation, its trialability, the need to develop substantial new skills and knowledge to use the innovation, and the up-front cost of the investment relative to the potential annual benefit from adopting this technological package.

Introduction

In the Arabian Peninsula (AP), rangeland ecosystems, which cover about 50% of the total area, are severely degraded due to the combined effects of overgrazing and harsh environmental conditions (Ouled Belgacem et al., 2013). In addition. the limited arable land and water scarcity constitute the main challenges of growth of AP agriculture. With the limited potential for agriculture sector, optimizing use of these limited resources for technology transfer in agricultural development while sustainably managing natural resources is one of the biggest challenges facing any decision-maker including the end users and growers. Thus, developing a sustainable and improved agriculture system would have a significant impact on helping these countries to shift their agricultural priorities from self-sufficiency to food security.

It is within this framework that ICARDA in collaboration with the National Agricultural Research Systems (NARS) has developed and introduced different technologies on rangelands rehabilitation including resting, planting native range species and water harvesting in different countries of the AP such as Kuwait, Qatar, Saudi Arabia (KSA) and Yemen. These technologies have increased the rangeland productivity, rainwater use efficiency and the resilience of the livelihood of some pilot livestock owners. However, the dissemination at larger scale and the adoption of these technologies by end users was not evaluated.

In line with the knowledge gaps above justified, a research study has been conducted in Saudi Arabia and Qatar with the purpose to enhance the adoption and accelerate its process and scaling up of these promising technologies. More precisely, the study aims:

- to estimate the expected rate of adoption of rangeland rehabilitation technological package (planting native range species and water harvesting) in KSA and Qatar through using ADOPT (Adoption and Diffusion Outcome Prediction Tool) software,
- to understand the perceptions of AP research and extension system on the impact of ICARDA-APRP technologies characteristics on adoption levels, and consequently to identify main adoption barriers and constraints, and
- to draw recommendations to promote adoption, ensure scaling-up and widespread use of these innovations.

Methods and Study Site

Adoption and diffusion outcome prediction tool (ADOPT)

The use of new agricultural technologies has been found to be a function of farm and farmer characteristics and specific features of the technology (Feder et al., 1985; Marra and Carlson, 1987; Rahm and Huffman, 1984; Akroush and Dhehibi, 2015; Kuehne et al., 2017). A considerable set of literature has been developed regarding factors that influence the adoption of new technologies by end users (farmers, agro pastoralists, etc.) using innovation theory (Feder et al., 1985; Griliches, 1957, and Rogers, 1995).

ADOPT[1] is an MS Excel-based tool that evaluates and predicts the likely level of adoption and diffusion of specific agricultural innovations with a particular target population in mind. ADOPT users respond to qualitative and quantitative questions for each of twenty-two variables influencing adoption. Going through this process also leads to increased knowledge about how the variables relate to each other, and how they influence adoption and diffusion. The tool has been designed to: (i) predict the likely peak level of adoption of an innovation and the time taken to reach that peak; (ii) encourage users to consider the factors that affect adoption at the time that projects are designed, and (iii) engage research, development and extension managers and practitioners by making adoptability knowledge and considerations more transparent and understandable.

Likert-type scale

The rangeland rehabilitation evaluated technology (i.e., package, in this case) characteristics scored by using 6-point Likert scale which are ordinal scales used to determine researchers and extensionists levels of agreement or disagreement on opinions and perceptions towards this technological package characteristic component (where scoring 1 refers to a respondent not sure/not applicable with a statement and 6 rates the respondent strongly agrees with the same statement). These characteristics were the followings: divisibility of the technological package; compatibility of the technological package; communicability of the technological package; easy to follow up; easy to implement; environmental benefits; reduce risk; increase profit; reduce costs; affordability of the technological package; complexity of the technological package; and finally, if the technological package need skills know.

Data collection and adoption and diffusion outcome prediction tool (ADOPT) analysis:

Regarding the implementation of ADOPT, a focus group discussion (FGD) methodology (Krueger, 2002) has been used to apply the ADOPT (Kuehne et al., 2013) with group of agro pastoralists. They were asked to think about their problems related to implementing the rangeland rehabilitation technological package and its adoption drivers in their respective countries. We streamlined 22 discussion questions around four categories of influences on adoption such as (i) characteristics of the innovation; (ii) characteristics of the target population; (iii) relative advantage of using the innovation, and (iv) learning of the relative advantage of the innovation.

Data collection and Likert-type scale (LS) analysis: To implement the LS tool for measuring KSA and Qatari's researchers and extension agents' perception and agreement with the evaluated package characteristics and for identifying the critical constraints to the adoption of such package in both countries, a survey response using scale categories (1 refers to a respondent not sure/not applicable with a statement and 6 rates the respondent strongly agrees with the same statement) has been conducted in 2018 and targeted the agricultural research and extension centers managers and extension staff in the two countries (Qatar and KSA).

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1 All information concerning how ADOPT works was found at: http://aciar.gov.au/files/node/13992/adopt_a_tool_for_evaluating_adoptability_of_agric_94588.pdf.

Results

Predicted adoption levels and factors affecting the adoption of rangeland rehabilitation technological package

The analysis of the empirical findings presented in Figure 1 related to the predicted level of adoption for the rangeland rehabilitation techniques introduced within the framework of the project. There is a huge difference between KSA and Qatar on the predicted peak of adoption of this package. Although, the predicted years to peak such adoption are around 18 years, the peak of adoption is expected to be 92% for KSA and 11% for Qatar (Figure 2). This predicted peak remains very low even during the first 5 and 10 years for the case of Qatar. This difference is due to the fact that rangeland rehabilitation technologies is widely diffused and used in KSA. Therefore, in Qatar, its speed of adoption is very low.

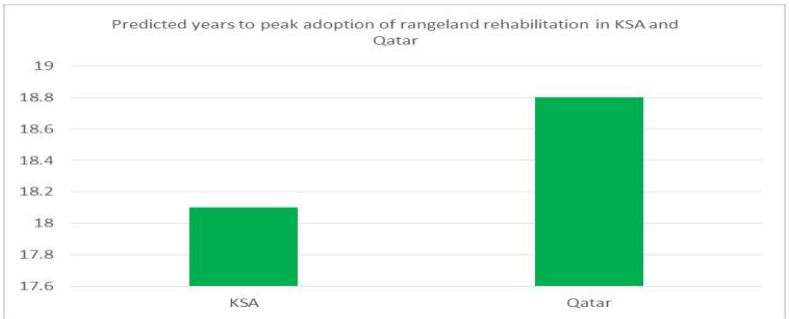

Figure 1: Predicted years to peak adoption of rangeland rehabilitation in KSA and Qatar (years). Source: Own elaboration from data analysis (2020).

The sensitivity analysis reveals that many factors are constraining this peak level of adoption mainly for Qatar. These factors are the complexity of the innovation, its trialability, the need for agro pastoralists /communities to develop substantial new skills and knowledge to use the innovation. In addition, the problem linked to the up-front cost of the investment relative to the potential annual benefit from using this technological package. This implies that decisions makers should take into consideration those elements when developing extension programs and effective extension services in Qatar.

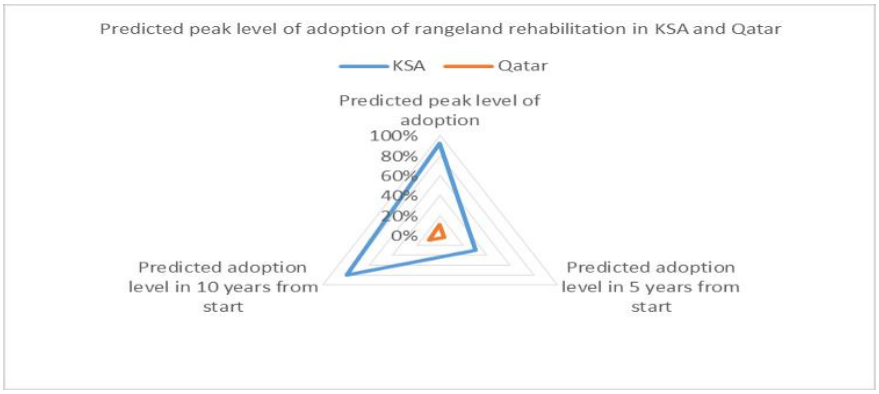

Figure 2: Predicted peak level of adoption of rangeland rehabilitation techniques in KSA and Qatar (%). Source: Own elaboration from data analysis (2020).

Basic criteria and assessment of rangeland rehabilitation technological package: Technological package characteristics, R&E perceptions and adoption decisions

Rangeland rehabilitation technologies were perceived as complex innovation (Figure 3). The assessment of the constraints to its adoption (from agro pastoralists /communities' perspective) suggest the need for these end users to develop substantial new skills and knowledge to use the innovation. In addition, the problem is linked to the up-front cost of the investment relative to the potential annual benefit from using this technological package, non-existent framework of incentives, and weak institutions. It is a long-term benefit technological package and our findings imply that rangeland resource management technologies are suitable, relevant and could offer the means to improve agro-pastoral livelihoods.

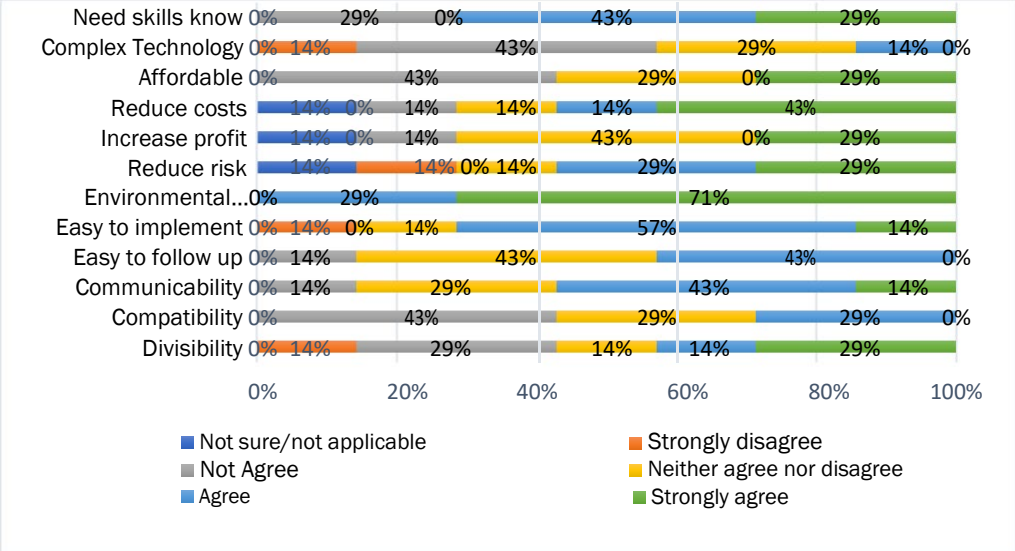

Figure 3. Net stacked distribution of the concerns over twelve major characteristics of the rangeland rehabilitation technological package
Source: Own elaboration from survey data (2020).

Discussion [Conclusions/Implications]

The assessment and identification of factors influencing adoption of rangeland rehabilitation technologies by agro-pastoralists in the AP with special focus on KSA and Qatar leads to the following conclusions:

- A large difference on the predicted level and time to peak adoption between KSA and Qatar regarding this technological package (planting native range species and water harvesting) has been examined.
- Despite its complexity, there is a willingness from agro-pastoralists in KSA to adopt the rangeland rehabilitation technological package.
- The predicted years to peak such adoption are around 18 years, and the peak of adoption is expected to be 92% for KSA and 11% for Qatar. This predicted peak remains very low even during the first 5 and 10 years for the case of Qatar.
- The characteristics of the technological package is a determinant on its level to peak adoption and on the time to peak the corresponding adoption level.
- Technical assistance, substantial new skills and knowledge, up-front cost of investment, financial resources and effective extension advisory services are considered the main factors enhancing the adoption of these technologies.

Arising from the findings and conclusions, this research suggests the following:

- To accelerate the adoption process of these technologies, it is imperative to create favourable conditions (i.e. creation of micro catchments, develop appropriate policy and strategies for rehabilitation, promote integrated approach to planning and management of rangeland resources, etc., so that a greater number of agro pastoralists can take advantage from the benefits of such technologies. This is through a concerted effort to heighten awareness about the rangeland resource management technologies over practical demonstrations.
- It was clear that one of the most highlighted constraints to rangeland rehabilitation technologies adoption is the up-front cost of investment. A large investment costs may discourage the adoption of these technologies. This suggest the creation of national supporting financial policy program through smallholder credits that could be an important adoption driver to overcome financial constraints to investment in this innovation.

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References

Akroush, S., Dhehibi, B. (2015). Predicted willingness of farmers to adopt water harvesting technologies: A case study from the Jordanian Badia (Jordan). American-Eurasian Journal for Agricultural and Environmental Science, 15 (8): 1502-1513. http://dx.doi.org/10.5829/idosi.aejaes.2015.15.8.12720.

Feder, G., Just, R., and Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. Economic Development and Cultural Change, 33(2), 255-298.

Griliches, Z. (1957). Hybrid corn: An exploration in the economics of technological change. Econometrica, 25, 501-522.

Marra, M., and Carlson, G. (1987). The role of farm size and resource constraints in the choice between risky technologies. Western Journal of Agricultural Economics, 12(2), 109-118.

Ouled Belgacem A., Al Kaabi N., Al Wawi H., Louhaichi M. 2013. Effect of livestock grazing on plant cover and species diversity in desert rangelands: A case study of Musawar Al Ottoria in Qatar. Range Mgmt. & Agroforestry: 34 (1): 88-92.

Rahm, M., and Huffman, W. (1984). The adoption of reduced tillage: The role of human capital and other variables. American Journal of Agricultural Economics, 66(4), 405-413.

Rogers, E. (1995). Diffusion of innovations (4th ed.). New York: The Free Press.

Kuehne, G., Llewellyn R., Pannell, D., Wilkinson, R., Dolling, P., Ouzman, J. (2013). ADOPT: The Adoption and Diffusion Outcome Prediction Tool (Public Release Version 1.0, June 2013) [Computer software] Adelaide SA; CSIRO. Available from www.csiro.au/ADOPT.

Kuehne, G., Llewellyn, R., Pannell, D.J., Wilkinson, R., Dollingd, P., Ouzman, J., Ewing, M. (2017). Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy. Agricultural Systems, 156, 115-125.

Krueger, R.A. (2002). Analysis: Systematic Analysis Process. Website. Accessed November 12, 2016, at www.tc.umn.edu/~rkrueger/focus_analysis.html.