Agricultural Economics & Marketing Journal, 8 (1): 01-04, 2021
ISSN 2079-2042

A Review Paper on Agro-Economic Impact of Water Consumption Rationalizing on Field Crop Production in Desert South of Libya

[1]Abdulla K. Abdullah, [2]Y.A. Al-Hendawi, [3]Aiad A. Alzway and [1,4]R.A. Al-Hendawi

[1]Faculty of the Natural Resources and Environmental Sciences,
University of Omar Al-Mukhtar, El-Bieda, Libya
[2]Botany Department, Faculty of Science, University of Omar Al-Mukhtar / Al-Qubba Branch, Libya
[3]Botany Department, Faculty of Science, University of Omar Al-Mukhtar, El-Bieda, Libya
[4]Chairman of the Libyan African Agricultural Holding CO (LAGICO), Tunisia

Abstract: It seems that the shortage of water resources is due to several reasons, the most important of which is the great depletion of water resources to meet the growing needs of population growth and the rapid growth in the agricultural, industrial and urban sectors, Meanwhile, Libya is located within the arid and semi-arid regions, which are characterized by low and fluctuation in rainfall rates and thus low groundwater recharge rate. As a result of the depleting pumping of groundwater, especially in the desert areas (No rainfall), which negatively affects the low levels of the groundwater level. It is essential to compensate the shortfall. This requires taking some measures, perhaps the most important of which is the development of water sources in the desert. New innovations should be employed to overcome this situation for agricultural projects in Libya, which were addressed in this study, using the HUDZ SOIL product, and the cultivation of drought - and salinity - resistant varieties of grain. The results of the study reflect a high yield of the crop production and very appropriate rates of water consumption.

Key words: HUDZ SOIL product · Wheat · Barley · Arid environments · Water saving · Libya · Economic Study

INTRODUCTION

Wheat production under irrigated conditions with scarcity of water resources for many developing countries is considered a risk that may lead to depleting the underground water reserves [1]. Most of cereal crops in Libya are grown under center pivot irrigation systems. However , this is considered to be one of the tools for wasting water due to poor design, as well as it works under a desert climate characterized by high temperatures [2].

Although there are no accurate statistics about the areas that are planted with the wheat crop annually by the private sector in the southern regions of Libya, we did a semi-field survey with some wheat producers in some southern regions of the Libyan desert, where the total area of the circles (central irrigation pivot) ranged Before the outbreak of the Libyan revolution of February 17, 2011, indicate the public and private sector owns 70-80 thousand hectares, with the production about 160-180 thousand tons of wheat annually and this production costs Libya a significant depletion of groundwater reserves in the desert areas [3].

Water consumption of the irrigated hectare varies from one region to another, reaching a maximum of 30000 thousand cubic meters annually in the southern regions. If we assume that the average hectare consumption of water in the southern regions is estimated at 15000 thousand cubic meters annually, then the total amount of water needed to cultivate 80 thousand hectares of wheat and barley under desert conditions (public and private sectors) estimated at 1.2 billion cubic meters annually [4].

There is no doubt that the production of grain crops under the irrigated system in desert projects that are characterized by an abundance of groundwater reserves is better and more than the production of grains under rain-fed agriculture, but it is often uneconomic due to the high costs of water extraction and the costs of adding fertilizers, pesticides and all other production inputs in addition to the severe desert climatic conditions [5].

Corresponding Author: Abdulla K. Abdullah, Faculty of the Natural Resources and Environmental Sciences, University of Omar Al-Mukhtar, El-Bieda, Libya. P.O. Box: 919.

The center pivot irrigation system isused in all public and private desert agricultural projects in Libya and is considered one of the most important systems used in the cultivation of field crops. The adoption of this type is due to several reasons, perhaps the most important of which is the ability of this type to irrigate large areas of land in addition to saving labor costs due to the operation of the system. Moreover, It is also assumed that the center pivot irrigation system has a good efficiency compared to surface irrigation systems which is not applicable. However, it is proven that many of these systems in desert agricultural projects have become tools that waste water due to the high pumping rates (76-80 liters / second / well). Axial sprinkler irrigation leads to a large depletion of water as a result of evaporation processes, especially in desert areas characterized by high temperatures and winds [6].

Moreover, there is a long-term threat that could cause a shortage of water resources and this may come from the risk of global warming, as some studies indicate that an increase in air temperature will lead to an increase in water requirements for irrigation water. Some of these studies showed that the increase in air temperature by two degrees may cause a significant decrease in the amount of rain and a deterioration in global food security [7].

Saving irrigation water may not always be the main factor in obtaining the required production, as studies confirm that farm management plays a major role not only in rationalizing irrigation water consumption, but also in obtaining high and good quality production in addition to saving energy and labor. Appropriate agronomic practiced such as plowing, planting dates, seeding rates, adding fertilizers at appropriate rates and weed control , diseases, pests and agricultural insects are among the priorities of successful management in increasing agricultural production and maintaining food security in Libya [8]. Also, successful management plays an important role in conserving groundwater by adopting ways and means to ensure optimal and better use of water in agriculture.

From an economic point of view, the yield of agricultural products must exceed production costs. It is known that the costs of irrigation in the dry and semi-arid regions of the world represent a large part of the total annual costs of crop production [9]. Accordingly, the policy of supporting the agricultural sector should not encourage excessive water consumption.

It is known that crop production costs varying amounts of water, but the question that comes to mind is whether this water has an appropriate economic return from agricultural production in desert projects. In the sense that if the production of wheat or barley, for example, costs a certain value and its value in the market is low, in fact we are consuming quantities of water for a small financial return. Therefore, it may be appropriate to adopt a water strategy linked to the yield of the crop, giving priority to crops that have a remunerative economic return and thus can rationalize the water uses by scientific methods as described below in this study.

Methods of Rationalizing Water Consumption in Desert Agricultural Projects: There are many scientific and technical solutions that ultimately lead to saving irrigation water, maintaining its quality and increasing yield production in quantity and quality, through the proposals supervised by researchers in the Kufra Agricultural Production Project [10]. They are as follows:

Use of Soil Conditioners and Fertilizers: The ideal solution for the cultivation of sandy soils in desert projects is the search for a natural soil conditioner and fertilizer that increases the soil's ability to retain water and nutrients that are added to it in the form of chemical fertilizers. The new product, HUDZ SOIL (HS), is one of the latest new American technologies in the field of cultivating desert sandy soils with minimal effort and less cost, as it is used once and its effect continues in the soil for several years, ranging between 3-5 years [10]. Through research and experiments conducted on this product, the product HUDZ SOIL (HS) is characterized by the following (Table 1 and Table 2).

The total amount of irrigation water needed to grow 80, 000 hectares of wheat and barley in desert projects in Libya is estimated at 1.2 billion cubic meters annually, according to the above-mentioned assumptions. In the case of using the organic improver and fertilizer HUDZ SOIL (HS) at a rate ranging between 10-12 m^3 / hectare, this will lead to a saving in irrigation water quantities of up to 600 million cubic meters annually [10] and assuming that the price of a cubic meter (m^3) of irrigation water is within the limits of [0.5 Libyan dinars]. Therefor the value of what is saved from this water is estimated at [300 million Libyan dinars] annually, which is equivalent now to a value of 67 million dollars / year. The saved water can be used to grow other crops that are more feasible in terms of water and economics.

Table 1: HUDZ SOIL product characterization

- Saturation Capacity (S.P) up to 3000%.
- Saves about 50% of water
- It saves between 20%-40% of the added fertilizers.
- Increases production at a rate ranging between 15% - 25% in the case of availability of all optimal agricultural operations.
- It achieves the highest rate of root growth compared to other types of soil.
- Increases the percentage of germination up to 300% compared to sandy soils and 150% compared to clay soils.
- Manufactured from 100% agricultural and cellulosic residues.
- Free from any insect, pesticide or weed seed contamination.
- Chemically neutral.
- Regulates the absorption of nutrients available in the soil
- Ease of use while saving time and effort.
- It is used in the cultivation of field crops, vegetables, fruit trees, gardens and green spaces.

Table 2: Physical and chemical properties of the HUDZ SOIL (HS) compound.

Specific analyses	Unit	Concentration	Specific analyses	Unit	Concentration
Density	kg/m^3	255	OM	%	78.16
Moisture	%	3	OC	%	45.33
Saturation	%	380	C:N ratio	-	35.41:1
Ash	%	21.84	Na^+	meq/l	8.6
pH(10-1)	-	7.6	K^+	meq/l	2.3
EC (10-1)	dS/m	1.4	Ca^{++}	meq/l	9.6
Total Nitrogen	%	1.28	Mg^{++}	meq/l	7.0
NH_4 - N	ppm	1638	CO_3^{2-}	meq/l	0.0
Nitrate -N	ppm	68	HCO_3^-	meq/l	0.5
Total P	%	0.08	Cl^-	meq/l	23.5
Total K	%	0.11	SO_4^{2-}	meq/l	3.5

Table 3: The amount of water required for wheat and barley in the case of using HUDZ SOIL product (HS) in all agricultural desert projects

No	Item	The amount of water required / year
1	Cultivation of 80 thousand hectares of wheat and barley without adding HUDZ SOIL product (HS)	1.2 billion cubic meters of water
2	Cultivation of 80 thousand hectares of wheat and barley in the case of adding HUDZ SOIL product (HS)	600 million cubic meters of water Saving 600 million m^3 annually
3	Cultivation of 80 thousand hectares of varieties wheat and barley that are tolerant of salinity and drought in the case of adding HUDZ SOIL product (HS)	300 million cubic meters annually Saving 900 million m^3 annually

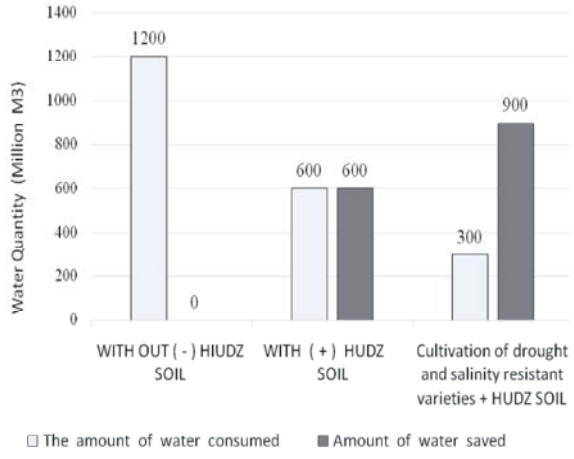

Fig. 1: The amount of water required to grow 80, 000 hectares of wheat, barley with or without HUDZ SOIL treatments and Cultivation of drought and salinity tolerant varieties with HUDZ SOIL treatment

Several researches and experiments indicated that this product, HUDZ SOIL, leads to an increase in production at a rate ranging between 15% - 25% and saving in the quantities of added fertilizers at a rate ranging between 20% - 40% (Table 1) in the case of applying all the optimal agricultural processes [10].

Cultivation of Drought-Tolerant Varieties of Wheat and Barley in the Case of Using HUDZ SOIL Product (HS): Large quantities of irrigation water can be saved by planting new varieties of drought-tolerant field crops, meaning that their water needs are few, which may reach 50% of the water requirements of wheat and barley varieties that are currently grown in civil and public desert projects. Thus, the estimated amount of water saved in this case is about 600 million cubic meters of water annually. There are different types of field crops that tolerate drought and early maturity (4 months) and by planting them large amounts of irrigation water are saved

compared to planting other late-ripening crops (6 months) or more [10, 11]. However, in case of adding HUDZ Soil (HS) product along of this approved method before planting this varieties a significant water conservation value can be saved up to 900 million cubic meters of water annually (Table 3 and Fig. 1).

CONCLUSION

In this study, the researchers suggest planting varieties of wheat and barley that are tolerant of salinity and drought in desert Libyan soils, in addition to adding HUDZ Soil (HS) product as shown in the study which gives high productivity. The results shown in (Table 3 and Fig. 1) indicate a significant water conservation value by using this approved method as well described in this agricultural economic study.

REFERENCES

1. El-Tantawy, Attia, 2000. Water resources in Libya. The publisher is the Egyptian Office for the Distribution of Publications Egypt.
2. Alhendawi Ramadan, A., 2005. Water Balance Investigation on the Main Great Reservoirs in Libya. Report Prepared for Ground Water in the Libyan Sahara Regions Conference, Ghat, Libya, 15-16, 11; 2005.
3. The Libyan Ministry of Agriculture, 2006. Statistical Reports on Cereal Crops Production in Libya.
4. General Authority of Water - Libya, 2010. Report on Water consumption and agricultural uses in desert projects.
5. General Authority of Water - Libya, 2004. Report on Water consumption and agricultural uses in desert projects.
6. Agricultural Research Center (ARC) - Libya, 2008. Central Library of Agricultural Research, Tripoli - Libya.
7. Gary M. Paulsen, 2004. High Temperature Responses of crop plants. Series online ISSN: 2691-2341.
8. FAO, 2021. Food and Agriculture Organization of the United Nations Warns of Deteriorating Food Security in Libya (Scientific Report).
9. Kufra Production Project (KPP) - Libya, 2005. Agriculture Research Center - KPP - Agriculture Economic Study (Field Work).
10. Kufra Production Project (KPP) - Libya, 2005-2010. Agriculture Research Center - KPP - Agriculture Economic Study (Field Work).
11. Alzway. A., K. Murphy and H. Flowers, 2013. Impact of high salinty of grounwater an irrigated agricultural land A. Case study Alkufra region. International Journal of the Environmental and Water, 2: 1-13.