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ENHANCEMENT IN CROP PRODUCTION IN THE ARID MEDITERRANEAN REGIONS

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ABSTRACT

The current review's goal is to draw attention to the potential for sustainable crop production in the arid Mediterranean region, which is predicted to experience more frequent and severe droughts in the future due to climate change, along with increased issues with soil salinity and higher temperatures. The area receives between 300 and 1000 mm of annual precipitation, which supports dry, semi-arid, and wet habitats. It is sometimes vital to concentrate on several stresses impacting the crop rather than examining each stress separately since stress elements frequently interact. In the Mediterranean nations, rainfed farming techniques are crucial. The question is whether we can use agronomic techniques to mitigate mild to moderate abiotic pressures. Utilising various crops with higher tolerances for salinity and drought as well as their built-in mechanisms for coping with stress could maximise agricultural yield. Supplemental irrigation, when employed as deficit irrigation, can, nevertheless, compensate for dry spells or hot weather. Improvements in crop output may result from a number of tactics, including early sowing made possible by less tillage, higher use of organic manure, and effective weed management. Crop rotations will also be crucial in enhancing weed control, lowering the risk of disease, and boosting nitrogen availability. High value cash crop products and more resilient crop rotations may come from the introduction of drought- and salt-tolerant crop species like quinoa, amaranth, and Andean lupin. Genotypic changes may result from selection for traits including early vigour, deep roots, greater disease resistance, increased

transpiration efficiency, and high assimilate storage and remobilization. To maximise agricultural productivity, a variety of crop and management practises may be combined for a particular target environment. Future decision support systems for crop production at low water availability in the arid Mediterranean region can then employ these combinations as recommendations.

KEYWORDS: Rainfed, Mediterranean, crop, production, temperatures.

INTRODUCTION

Freshwater is a resource that is becoming more scarce (WFD, 2000). The demand for water is anticipated to rise along with the world population and living standards. During the growing seasons, there will be a severe water shortage in many parts of the world, which could have an impact on natural ecosystems (Jury and Vaux, 2007). In the past ten years, the Mediterranean region and other regions of Europe have experienced considerable output losses due to increased climatic variability, particularly extreme drought occurrences. In a single growing season, crops may experience multiple extreme events (Wollenweber et al., 2005).

To ensure that there is enough water for agricultural output, municipal and industrial uses, and ecosystem processes, it is crucial to increase the efficiency of water use within agricultural systems. A variety of disciplines should collaborate in an organised way to handle the complexity of pertinent interconnections in order to ensure stable food production globally in the face of changing climatic conditions.

The Common Agricultural Policy (CAP), the European Water Framework Directives (WFD), and specific rules like the Nitrates Directive and the Groundwater Directive are EU policies that have an impact on agriculture and water. Water in Agriculture (TWG4, 2006), a strategy paper on the future of water use, was just finished. The concept outlines the efficient use of water in agriculture to boost food production while preserving the environment. In a broader sense, the water-saving potential of families, businesses, energy, and agriculture has been studied (EU Water Saving Potential, 2007).

The report made several recommendations, including avoiding overexploitation, utilising unconventional water sources, and encouraging coordinated water conservation on a regional level. In the European Union, water scarcity and drought are common and pervasive

phenomena. It is no longer unusual for there to be a long-term imbalance caused by water demand surpassing available water resources. According to estimates, water scarcity had a negative impact on 17% of Europe's area and at least 11% of its people by 2007. If temperatures continue to rise due to climate change, the Commission anticipates significant deterioration of the water situation in Europe. All 500 million Europeans are increasingly concerned about the issue of water, rather than just a few specific regions (EC Environment, 2011). In the EU, there is a 40% potential for water savings (EurActive, 2010a). Agriculture is responsible for up to 80% of water abstraction in several southern member states of the European Union, according to the European Environment Agency. According to the Commission, agriculture is the top industry where water scarcity mitigation measures need to be taken (EurActive, 2010b).

A long time ago, the Mediterranean region—particularly the Middle East and North Africa—ran out of replenishable freshwater. With barely 1% of the world's freshwater resources, the area is one of the driest agricultural zones on the planet. The Mediterranean region has a climate that is highly varied and transitional between dry tropical and temperate climates, with hot, dry summers and cool, wet winters (Ceccarelli et al., 2007). This climate occurs on the west coasts of all continents between latitudes 30 and 45° due to global air circulation patterns. Mediterranean climate is associated with an area of about 2.76 million km^2, corresponding to 2.3% of the Earth's land surface. The largest part is the Mediterranean region with 1.68 million km^2 (60% of the total area of Mediterranean climate), followed by 0.61, 0.28, 0.13 and 0.06 million km^2 for Western Australia, California, Chile and South Africa, respectively (Joffre and Rambal, 2002).

According to predictions made by the Intergovernmental Panel on Climate Change (IPCC, 2001, IPCC, 2007), the Mediterranean region, which includes southern Europe, would experience drier and hotter summers as well as hot, dry spells. The issue is more complicated during the winter. By the year 2050, rainfall during the winter (October–March) is predicted to increase in central and eastern Spain and north of Italy, while in the southern Mediterranean countries rainfall will decrease by 10–15% (Ragab and Prudhomme, 2002). The average temperature in the Mediterranean region will increase by 1.25–2.5 °C in winter (Ragab and Prudhomme, 2002). High temperatures may occur late in the winter growing season during seed filling. Salinization of costal aquifers will further exacerbate the situation (Wang et al., 2003).

The largest user of freshwater is irrigated agriculture. Over 40% of food is produced on irrigated land globally (FAO, 2006). More than 60% of the water used in South Europe is for irrigation (EIIE, 2000). For this reason, we must concentrate on making the best use of our water resources in agriculture. So, for farming systems in water-scarce places, maximising water productivity rather than yield per unit of land—is a strategy (Oweis and Hachum, 2006). For example, in North Africa, the frequent droughts and inefficient water use are endangering livelihoods.

Section snippets

Multiple abiotic stresses

At different levels, including the overall plant, the root, the reproductive structures, the leaves, and the cellular and molecular levels, plants respond to stress and adapt. For example, plants can store osmolytes and proteins that are especially implicated in stress tolerance. The main limitations in agriculture are stresses brought on by salinity and drought (Gregory, 2006). Increased water consumption is necessary because drought and increased salinization of agricultural land could cause a 50% loss of land by the year 2050 (Wang et al., 2003).

Water saving irrigation strategies

In many agricultural systems, better management is a viable way to boost water usage effectiveness (Steduto et al., 2007). In addition to enhancing dry land farming techniques, water conservation is crucial to maintain high output in the future in drier conditions. It has been projected that using waste water for irrigation and improving water delivery to the field could both save up to 22% of the water used in European agriculture.

A System for biological water saving

There is a lot of indication that molecules like ABA, nitrate, and the pH of the xylem sap operate as signalling compounds for the above-ground sections of the plant to sense the soil water status (Jensen et al., 2010). In the soil-plant-atmosphere continuum, signalling cascades also incorporate ethylene, NO, and ozone (Wilkinson and Davies, 2010). Even though the importance of ABA, nitrate, and xylem pH as signalling substances has been repeatedly demonstrated in various plants.

Farming systems

In the Mediterranean region, there are four main farming techniques Cereals and cash crops (such as sugarbeet, cotton, and oil seeds) are the principal crops in the irrigated farming

system. In small-scale irrigated sub-systems with irrigated plots measuring 0.02-1 ha, the household typically manages a small number of animals that are fed a combination of pasture, agricultural leftovers, and planted fodder crops. There are still certain places where traditional irrigation techniques and water rights are used. Farming in the Highlands.

Advancing agricultural practices in dryland Mediterranean farming

In several nations of the Mediterranean, simple monocultures of wheat follow one another. Legumes are frequently used as break crops due to the growing drought issues. The Mediterranean region's productivity and standard of living could be enhanced by making the best use of crop rotations that include wheat, grain legumes, and new crops that are adapted to the target environment, such as rainfed, supplemental regulated deficit irrigation, and saline conditions.

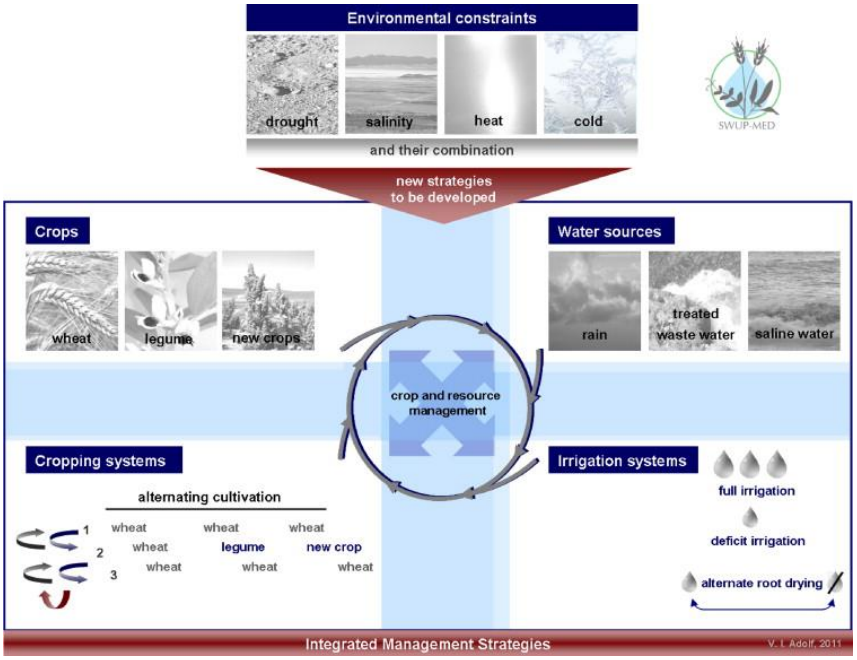

Fig. 1: Improving crop production in arid Mediterranean climate.

CONCLUSION

In this paper, we have discussed the potential for sustainable crop production in the Mediterranean region's arid climate. The alternative is to utilise different crops' drought adaptation mechanisms to overcome mild to moderate levels of abiotic stress through agronomic methods in order to maximise crop yield as a guide for future decision support systems for agricultural production with restricted water supplies. Even in challenging environmental circumstances, possibility exists.

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