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Yield Stability and Quality of Wheat (Triticum spp.) and Barley (Hordeum Vulgare) Populations Evolving under Different Microenvironments: A review.

***Amal Al-Khatib* [1*], ***Omar Kafawin* [2] *and Stefania Grando* [3]

[1] Field Crops Directorate, National Agriculture Research Center-NARC, Jordan

[2]Department of horticulture and crops, School of Agriculture, University of Jordan, Amman, Jordan

[3]Consultant, Ascoli Piceno, Italy

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ABSTRACT

Climate change, human population growth, human health and food security, safety, and sovereignty all demand that the role of biodiversity in plant breeding be revisited. From a biological standpoint, it is possible that populations of diverse plants developed by evolutionary plant breeding will be able to handle the majority of these major issues. Water stress and soil nutrient deficiency may have a negative impact on wheat (Triticum spp.) and barley (Hordeum vulgare) yields and qualities. Drought-tolerant wheat cultivars with high yield and quality potential and improved grain protein content must be developed if food security is to be maintained. Wheat and barley (Triticum spp. and Hordeum vulgare, respectively) are the focus of this research, which aims to examine the stability of evolutionary populations (EPs) in the face of stressful and changeable settings. It's also important to look at how evolved populations stack up against improved varieties in terms of yield and its components. There has not been much progress in making wheat and barley more resistant to drought, especially in Jordan, where the problem is felt the most.

Keywords: Evolutionary populations, Wheat (Triticum spp.), Barley (Hordeum vulgare), Plant breeding, Yield, qualities, stability.

INTRODUCTION

Based on the most recent United Nations estimates, the current global population of 7.9 billion is predicted to increase to 8.6 billion in 2030, 9.8 billion in 2050, and 11.2 billion in 2100 (United Nations, 2019; KC & Lutz, 2017). This increased population, combined with changing dietary habits in developing countries toward a more westernized patterns high in sugars, fats, and animal-source foods, and increased use of grains for livestock feed, expect global crop production to double by 2050. However, land suited for agricultural production is scarce, and the majority of soils with high productivity potential are already under cultivation. Furthermore, water supply is limited, and in some regions, such as the Orinoquia region (Colombia), land resources are exhausted and the cultivated area is decreasing (Pramanik et al., 2019; Ramirez-Contreras et al., 2022; Cherubin et

* Corresponding author.E-mail: *amalkht@narc.gov.jo*

al., 2021). Given these constraints, increased levels of sustainable production are desperately required.

Wheat and barley are major staple food. Today, barley is still a significant staple grain in many areas, including North Africa, the Near East, the highlands of Central Asia, the Horn of Africa, the Andean countries, and the Baltic States. Food barley has largely been neglected and consumed relatively little in wealthy nations recently. Major staples are maize, rice, wheat, cassava, soybeans, potatoes, and sorghum. Because of these plants' agronomic flexibility and ease of turning grain into flour for generating edible, tasty, intriguing, and gratifying dishes, they constitute an important diet component (Zhou, 2009; Dawson et al., 2015; Jones, 2021; Wang et al., 2022). However, wheat and barley production is expected to fall short of demand in most regions of the globe owing to a number of biotic restrictions, including the numerous effects of climate change and low soil fertility (Liliane& Charles, 2020; Solh & van Ginkel, 2014). Water scarcity and inadequate soil fertility are two major restrictions to global wheat production (Waddington et al., 2010; Ali & Akmal, 2022). The average rainfall across the globe has dropped as a result of climate change, and rainfall distribution has grown more irregular (Mafongoya et al., 2022; Haque et al., 2012).

Climate has a large impact on crop development because plant physiological systems react immediately to variations in air and soil temperature, solar radiation, moisture availability, and wind speed (Al-Ghzawi et al., 2019). Wheat (Triticum spp.) and barley (Hordeum vulgare) yield stability and quality have received attention in the past decades (Slewinski, 2012; Mansour et al., 2018). It is expected that hybrids have greater yield stability than inbred lines, but experimental evidence validating this concept for autogamous grains is sparse (Weih et al., 2021).

The majority of development in introducing new varieties over the previous five decades has come through conventional breeding (Araus et al., 2008). In general, such traditional approaches have prioritized yield as the primary feature for selection, with a clear disregard for other key traits like resistance to biotic and abiotic stressors. Indeed, the primary goal of barley and wheat breeding programs is to maintain greater and more stable yields in variable settings (Verma et al., 2017). Crop breeders are now focused on increasing cereal production by enhancing yield stability via increased resistance to biotic and abiotic challenges (Abtew et al., 2015).

Physiology, growth, water relations, and yield are all adversely affected by the combination of drought, high temperatures, and other stresses (Verma et al., 2017). Drought tolerance in barley and wheat may be improved by selection based on a combination of criteria (Khayatnezhad et al., 2010; Nazari & Pakniyat, 2010). In significant measure, the capacity of agricultural production systems to adapt to global climate change will be decided by the degree to which barley and wheat adapt.

Researchers have pointed out that in order to accurately choose promising and broadly adaptable barley genotypes, the average yield and stability must be taken into account concurrently (Ajay et al., 2020; Verma et al., 2017; Jandong et al., 2019). Consequently, many breeders throughout the globe are working hard to enhance barley productivity in dry locations and generate varieties with excellent yield stability in changing circumstances (Hatfield & Beres, 2019; Abtew et al., 2015). Aside from climate change and poor yield, the development of barley and wheat varieties tailored to various conditions is critical.

For instance, the development of high-yielding cultivars with resistance and/or tolerance to stressors is necessary for Jordan (Al-Abdallat et al., 2017; Al-Ghzawi et al., 2019). Improvements in barley and wheat production per unit area and the identification of new varieties with enhanced drought tolerance are considered essential for crop improvement under rainfed circumstances in Jordan. This review aims to investigate the yield stability and quality of wheat and barley populations evolving under different microenvironments. Besides, breeding approaches for increasing drought resistance, climate change, and water use in wheat and barley populations that are developing in diverse microenvironments are assessed in this research.

Barley (Hordeum vulgare L.) is a member of the Poaceae family, the Triticeae tribe, and the Hordeum genus (Bennett & Smith 1976; Taketa et al., 2003). It is self-pollinated, with less than 1% outbreeding (von Bothmer & Komatsuda, 2010), and is a diploid species (2n = 2X =14) with a 5.1 Gb haploid genome (Mayer et al. 2012). Because of its diploid nature, great phenotypic variety, ease of hybridization, and ability to generate mutations that assist chromosomal sequencing and mapping, barley has been frequently employed in genomics and genetics investigations (Sreenivasulu et al., 2008).

Barley may be grown in a variety of agricultural conditions across the globe. Its adaptability is controlled by environmental conditions, the most important of which are day length (photoperiod response) and cold temperature (vernalization requirement). Dijkman et al. (2017) say that advances in barley genetics and genomics have led to the discovery and characterization of important genes that control phenology and other important traits that help barley adapt to different production conditions.

Wheat (Triticum spp.) is the most widely consumed cereal crop in the world in a variety of forms. Global demand for wheat by the year 2020 is forecasted at around 950 million tons. This target will be achieved only if global wheat production is increased by 2.5% per annum. This increase in wheat production provided food security to India (Krupal et al., 2018). In comparison to other wheat species, bread wheat is a relatively new species. However, it is more adaptable than other wheat species and crops owing to its genetic variety, which allows it to live in a broader range of settings (Peng et al., 2011). The European Union, China, India, Russia, the United States, and Canada were the top wheat-producing nations. These nations account for more than half of the world wheat output (FAO, 2019).

Wheat (Triticum spp.) quality attributes are known to be influenced by genotypes, the environment, and their interaction (G x E). Several factors influence the quality of wheat, including growing season temperatures, humidity during grain filling, length of grain filling, and the date it was sown. Different agro-climatic conditions influence yield and quality attributes to fluctuate in wheat cultivars. As a result, phenotypically stable genotypes must be developed and identified so that they can consistently perform well in a variety of situations (Krupal et al., 2018). It is just as important to classify varieties, as it is to find the genotypes that grow wheat best in both good and bad conditions.

Historical and Theoretical Framework

Farming was the foundation of our ancestors' civilizations, and it continues to influence our lives now (Roudart & Mazoyer, 2015; Mazoyer, 2006). Wheat and barley crops are a key part of farming since they provide 50 percent of the world's needed carbohydrates, as well as food, animal feed, bioenergy, and pharmaceuticals (Mombo et al., 2016; FAO, 2017). Since the beginning of agriculture more than 10,000 years ago, there have always been challenges to overcome. To feed the world's growing population of over 7 billion people, we face enormous challenges, including the need to improve the efficiency of our agricultural systems (Godfray et al., 2010). Even if the amount of land that can be used to grow crops per person goes down because of climate change, productivity must go up (Powell et al., 2012).

The impacts of climate change are expected to be seen across Africa, the Arab World, Southeast Asia, and Central South America, according to a number of climate prediction models (Samson et al., 2011). A major factor in the distribution of wheat and barley is the effect of pest and disease damage, rainfall, temperature, and altitude. For early and intermediate-mature varieties, altitudes between 1500 and 1900 m are ideal, while locations between 1900 and 2300 m are ideal for transitional and late-season varieties. Height, temperature, and precipitation all have a role in the success or failure of certain wheat pathogens. Yellow rust is one such example, which can only be found in colder areas at higher altitudes than sea level (Hailu Gebre-Mariam et al., 1991).

Environmental factors, such as the duration of the growing season, the amount of precipitation, the temperature, and other similar variables, may have an impact on genetic performance. Both micro and macro environmental factors, such as soil type, agronomic practices, and climate regulation, may be identified and quantified. Micro factors include drought conditions, year-to-year rainfall fluctuations, and the severity of insect damage (Mather and Jinks, 1982). One of the most complex factors that affect productivity is the amount of grain that a plant is able to produce (Bhandari et al., 2021; Ferrio et al., 2008). The most important factors are those that influence grain production. Some yield-related factors to examine are days to flowering, days to maturity, plant height, thousand-grain weight, number of kernels per tiller, and test weight. As an example, these characteristics may have a positive or negative effect on yield, depending on how environmental conditions affect these properties.

As a result, it is crucial to know how grain yield and its constituent parts interact (Bruns, 2019; Moral et al., 2003). Wheat yields are difficult to anticipate because they are affected by so many different factors, such as yield components and the surrounding environment. According to research, the ability of plants to absorb nutrients from stalks and leaves, grain filling, assimilation acceptor capacity, and grain filling efficiency are all influenced by environmental conditions (total precipitation, drought, high and low temperatures) (Yan et al., 2019; Knežević et al., 2015). For example, drought stress can happen at any point during the growing season, but it has the most effect on yield during flowering (Chadalavada et al., 2022; Blum, 2005).

Furthermore, fertilizer N management, cultivar, soil fertility, water availability, and N absorption patterns before and during anthesis may all affect the link between barley grain yield and quality (De Ruiter, 1999). N is the nutrient that limits crop growth the most in the world's major agricultural areas, so farmers who use good N management practices often make a lot of money (Lemessa. & Gemechu, 2016). De Ruiter found in 1999 that the best yield can be reached at the top of the standards that are already in place. Malting barley farming faces a big problem: how to grow crops that meet the needs of maltsters and make enough money to cover the costs of production.

Plant density has a significant impact on the ability of cereals to compete (Doll et al., 1995). Barley yields in areas with medium to high rainfall were significantly lowered by increasing the seeding rate of barley (Li et al., 2019). By planting at a certain density level that is higher than ideal, it is possible to reduce grain size and promote lodging. When subsoil moisture levels are low or the ground is dry, a lower planting density will diminish production potential. High planting rates should be minimized in order to lower the weight of individual kernels and improve barley production (Cann et al., 2020).

Additionally, the length of a crop's growth phase from sowing to harvest affects its output. Even while early maturity is linked with better yields in places impacted by terminal drought and heat stress, a longer growing season has a favorable effect on yield in locations where environmental variables promote late maturing lines (Kafawin et al., 2005; Abu-Elenein et al., 2021; Sattar et al., 2020). Abiotic stress may be minimized by planning the length of the growing season and the onset of the various stages of plant growth in a timely manner. Increased grain yields are a consequence of this (Ding et al., 2020).

Conceptual Framework of grain stability yield and quality of wheat (Triticum spp.) and barley (Hordeum vulgare).

Since the 1960s, agricultural development and intensification have resulted in a dramatic rise in global food production. In any case, the future of the world's food supply is in doubt. Human populations have expanded at the same rate as food output in recent years. There is a growing disparity between the amount of food available and the amount people want because of factors such as climate change and a lack of new arable land. Barley and wheat, two of the world's four most important cereal crops, are likely to lose production as a result of global warming of 2 degrees Celsius by 2040. Because of this, it is very important to make systems that are more resistant to climate change (Arenas-Corraliza et al., 2019).

Crops that can thrive in agroforestry systems are anticipated to be defined by examining practical plant features that govern crop output. This is necessary to overcome the dearth of information about how low irradiance conditions would affect present cultivars (Mauromicale et al., 2010; Arenas-Corraliza et al., 2019). Studies on wheat and barley acclimation in Mediterranean climates to higher levels of photosynthesis have not been done yet. In the Mediterranean, where irradiance levels often exceed plant needs, temperature, and dryness are the principal photosynthetic constraints. As climate change impacts are expected to be more evident in Mediterranean regions, a new study has shown that tree presence significantly impacts winter wheat grain production (Rothstein & Zak, 2001; Hurry et al., 2002).

Other temperate and Mediterranean climate regions have not been able to demonstrate the impact of shadow on wheat yield. Nobody knows how darkness affects barley in Mediterranean regions. So far, more land has been planted with barley than with any other crop. Agroforestry research on climate change in shady areas could learn a lot from studying barley, which can change its photosynthetic efficiency even when there isn't much light (Arenas-Corraliza et al., 2019).

Araus et al. (2008) reported that conventional breeding has been the primary source of novel types over the last five decades. There was a clear lack of consideration for other key features, such as the ability to cope with both biotic and abiotic stressors, in the usual approach. Indeed, the primary goal of barley development programs is to maintain higher and more profitable products in the face of changing environmental conditions (Verma et al., 2017; Ahmar et al., 2020). Wheat breeders are now trying to increase grain production by making yields more stable and making wheat more resistant to both natural and unnatural stresses.

To maximize grain yield and kernel plumpness while minimizing grain protein, malting barley growers use several management practices that aim to maximize grain output while minimizing grain protein. Late planting may have an impact on the nitrogen fertilizer's effect on grain output (Belete et al., 2018). Grain yield, protein, and plumpness of barley kernels are all influenced by the seedling stage and N fertilizer management techniques, and later planting leads to lower grain yields and plumpness while increasing protein content in the grains (Lauer and Partridge, 1990).

Many scientists have pointed out that yield potential and stability must be taken into account concurrently in order to quantify genotype x environment (G x E) relationships and to make an accurate selection of promising and broadly suited barley varieties. Studies have pointed out that in order to accurately choose intriguing and remarkably flexible barley genotypes, the average yield and overall stability must be taken into account concurrently (Verma et al., 2017). For instance, the development of high-yielding cultivars with resilience and/or tolerance to stressors is needed in Jordan to sustain an increase in barley and wheat yields (Al-Abdallat et al., 2017). In Jordan, there is a small amount of rain most of the time, so increasing the amount of barley and wheat grown per unit of land and making new varieties that can handle drought better is important for crop improvement.

Resilience of Crops to Climate Change.

The climate change debate is becoming more urgent at both the local and global levels. Feng & Fu (2013) propose that as a result of global warming, dry and wet areas will become more different in climate. According to Pecl et al. (2017) and Thomas et al. (2004), certain research has projected that climate change might increase the rate of extinction in natural ecosystems. Climate change will have a negative influence on food supply and quality since the agricultural industry is very sensitive to climate change (Atkinson et al. 2008). The environmentally sensitive zone comprises arid and semiarid regions, mountains, and hills, all of which have few resources and are very diverse. This is also where the bulk of the rural poor people on the planet reside.

With climate change affecting wheat output and productivity, breeding for drought tolerance has long been considered a viable and cost-effective technique for increasing wheat yield and productivity in marginal areas. (Christian et al., 2021) found that early blooming, plant height, the number of tillers, the number of thousand kernels, and grain output all help plants handle drought.

With climate change affecting wheat output and productivity, breeding for drought tolerance has long been considered a viable and cost-effective technique for increasing wheat yield and productivity in marginal areas. It has been shown that drought tolerance can be increased through indirect selection for traits like early blooming, plant height, tiller number, thousand kernel weight, and grain production (Christian et al., 2021).

For instance, wheat production in sub-Saharan Africa (SSA) is hindered by a lack of water and a lack of soil fertility (Fahad et al., 2017). The average rainfall in SSA nations has dropped, and the distribution of rainfall has grown more unpredictable as a result of climate change (Worku et al., 2018). Winter rainfed production systems are affected by low rainfall and changes in the way it rains, especially when drought stress happens after flowering. Dryland wheat is grown using rain-fed systems in the winter, and it needs to have some moisture left over. (Shavrukov et al., 2017).

The availability of sufficient genetic variation for selection is essential for the success of drought-tolerance breeding. There have been earlier reports of genetic diversity for agronomic features that might be valuable in enhancing drought resistance (Ghaed-Rahimi et al. 2017). In order to improve drought tolerance in locally adapted wheat varieties, several international and national research programs and gene banks have access to world wheat genetic resources (Mwadzingeni et al., 2016). These resources include modern and obsolete wheat cultivars, landraces, breeding populations, and wild relatives. For improved Si intake to be successful, the breeding population must have enough genetic diversity in (Silicon) Si uptake. Stressed settings are the most common setting in which researchers examine Si's effects (Zargar et al. 2019). Drought resistance can be improved by exploiting genetic diversity for Si-utilization under drought stress circumstances, but this hasn't been extensively done, despite the importance of Si in plant nutrient absorption and remobilization and protection against biotic and abiotic stressors (Gokulraj et al. 2018; Prasanna et al. 2018). A considerable amount of genotypic heterogeneity in grass Si absorption was discovered by McLarnon et al. (2017). Drought tolerance was improved by the scientists' discovery that Si absorption increased under stress. Drought escape, avoidance, and tolerance might be paired with enhanced Si absorption to boost wheat production under marginal circumstances. Drought resistance and enhanced nutritional quality may be linked to efficient Si absorption at the same time. Si uptake may be enhanced by selecting parental lines that are more efficient at absorbing the element. These findings offer the basis for early generation selection since they show that wheat's Si-use efficiency may be passed down via genetics (Jackson et al., 2019).

Agronomic crop production is strongly influenced by local and regional climate conditions. Meteorological factors such as maximum and lowest temperatures, solar radiation, carbon dioxide content, and water availability all have an impact on plant metabolic activities. Extreme weather conditions, such as heat waves, storms, droughts, salinity, and floods, have an impact on the yield of cereal crops (Fatima et al., 2020). Nicholson et al. (2018) found that rainfall patterns in broad parts of Africa have changed throughout time. According to Pour et al. (2020), aridity shifts and changes in aridity in Iran might have a significant impact on agricultural productivity and food security. Different human activities that create greenhouse gases have influenced agricultural activity all over the world.

The phenology of plants has shifted dramatically as a consequence of small but persistent changes in air temperature. This century, and notably the last several decades, has seen significant climate change, primarily in the form of global warming. From 1980 to 2018, the average air temperature has risen by 0.95°C, and it is expected to rise by 3.0–5.0°C by the end of this century. Meanwhile, the global population has increased significantly and will continue to do so. By the middle of this century, the globe is anticipated to need 70% more food (Fatima et al., 2020).

Evolutionary plant breeding: its significance and practical application.

An estimated half of the increase in agricultural production may be attributed to advances in plant breeding, the most critical field of study when it comes to raising crop yields (Caligari & Forster, 2015). Increasing the productivity of a plant is an important aspect of the whole process of plant improvement (Kausch et al., 2013). During the "Green Revolution" of 1968, William S. Gaud invented the phrase "Green Revolution" to describe a development approach in which mostly self-pollinated crop types were produced in large quantities with high genetic homogeneity owing to their high productivity and wide geographic adaption.

They also had poor performance in marginal or non-supplemented environments, so these cultivars weren't recommended (de Ponti et al., 2012; Ceccarelli, 1996). Around 1.4 billion people live in marginal agricultural areas and have limited access to external inputs, including poor farmers, who rely on traditional agricultural practices (Altieri, 2002; Ceccarelli et al., 2022).

Modern plant breeding produces a small number of cultivars for high-input crops, reducing agrobiodiversity and endangering global food security for crops cultivated in climate-change-affected regions (Nelson et al. 2010). When it comes to agricultural biodiversity, the "re-discovery" has been going on for a few decades now. For abiotic stresses, disease prevention and management, and long-term system stability, biodiversity is cited as an important factor (Pandey et al., 2017). According to Estelle et al., (2014), the combination of human and natural mass selection under organic and low input conditions has resulted in OPVs (open-pollinated varieties) with substantial genetic variety (2014).

Some time ago, an evolutionary method for plant breeding existed. Harlan and Martini created the composite cross (CC) breeding strategy for barley in 1929. (Harlan & Martini, 1929). Using this technique, a diverse population of recombinant genotypes is generated from a large number of F1 offspring with varying backgrounds and genetic makeups. In 1956, Suneson codified and improved upon his "evolutionary plant breeding technique" (Suneson, 1956). Barley CCs grown in this manner were registered by Suneson (1969), who intended to use them as parental populations (PPs) for the creation of new kinds and as research material for natural population studies (Suneson, 1956). Allard and Hansche (1964) found that the long-term viability of mass-propagated populations is closely linked to how useful recombination and separation are in agriculture.

Plant breeding based on evolutionary-participatory principles is a step further than participatory plant breeding (PPB), (Kloppenburg, 2010). Evolutionary-participatory plant breeding, on the other hand, enables farmers to control their own genetic diversity without institutional help. Institutions of higher learning are not excluded from the process, although their involvement is not required. Institutions may play a role in the development of new populations (Ceccarelli et al., 2022). They may do this by crossing a certain number of kinds or by making available to farmers the leftover seed of early-segregating populations.

Baking and pasta quality

Baked goods' quality is a nuanced matter, due to the fact that it takes a long time to calculate directly. As an alternative, flour is subjected to a variety of physical and chemical tests, which are then used to derive an indirect quality score. Ash and moisture content, protein content, Hagberg falling number, and Zeleney sedimentation value are some of the metrics used to evaluate the quality of baked goods (Borla et al., 2004). A successful bakery product production process relies on the rheological qualities of wheat flour dough, which determines how it behaves during mechanical handling, impacting the quality of final goods. Hard and soft wheat flour's bread and cookie-making properties were studied using the alveograph method by Agyare and others (Yamlahi et al., 2013).

When protein is present in a product, its polymeric nature affects its rheological properties, making it more appealing to the customer, who is more likely to eat it. Even if a protein has a high nutritional value, it may lack the functional qualities necessary to be used in a certain food system or manufacturing process. In order to better understand how proteins are able to carry out their functions, researchers are eagerly pursuing a deeper understanding of their mechanisms of action in order to better tailor them for specific applications. Analysis of each sample showed that the product has the best protein qualities to produce a flour that is better suited for baking and noodles (Cerda-Mejía et al., 2017).

Rao et al. (2010) studied baking quality in wheat breeding lines (Triticum spp.) and found that the greater loaf volume was due to both heritable and enhanced gluten strength as well as improved dough extensibility originating from wheat (Triticum spp.). There have also been transgenic lines of emmer wheat that make better bread and are better for you (Lemaux and Qualset, 2001). These lines are ready for commercial production.

Future perspectives

A wide range of information about wheat (Triticum spp.) and barley (Hordeum vulgare) natural habitat and genetic diversity has not led to its full use in wheat (Triticum spp.) and barley (Hordeum vulgare) breeding. However, despite the utilization of wild germplasm for wheat (Triticum spp.) and barley (Hordeum vulgare) development, the genetic foundation of farmed wheat remains restricted. Modern wheat breeding's enormous increases in yield may have resulted in a major decline in the species' variety, which might jeopardize further selection. A detailed grasp of the wheat (Triticum spp.) and barley (Hordeum vulgare) plant's core biology and assigning roles to the tens of thousands of genes that have already been or will be found using functional genomics are necessary preconditions for further development in wheat breeding in this environment.

Genes that govern critical activities may be discovered using functional genomics to understand their fundamental biological impacts and eventually be used in breeding. Biochemical, physiological, and genetic investigations will benefit from this technique, as will the possibility of using the data for wheat improvement. In order to use wild genetic resources in the molecular breeding of wheat (Triticum spp.) and barley (Hordeum vulgare), it is recommended to incorporate association analysis into traditional breeding strategies. A population-based survey of genotypes should be employed in order to find trait-marker associations based on linkage disequilibrium.

An economically and environmentally sound answer to this challenge is the creation of new wheat (Triticum spp.) and barley (Hordeum vulgare) cultivars that are more water-efficient and have better drought tolerance. In certain wheat-growing locations, climate change may alter the disease spectrum, causing previously unnoticed diseases or pests to become significant new problems. Consequently, future research supporting existing and prospective wheat (Triticum spp.) and barley (Hordeum vulgare) breeding goals for biotic stressors must further analyze and improve the efficacy of screening for foliar disease resistance to vertical and horizontal genetic determination.

A key problem for wheat (Triticum spp.) and barley (Hordeum vulgare) breeders is how to use marker-assisted selection to improve complicated characteristics. When it comes to avoiding undesired features of wild emmer and facilitating the use of beneficial genes, marker-assisted gene introgression will be critical. The introduction of genes from natural genetic resources into the wheat genome, previously inaccessible via traditional breeding, was made possible thanks to genetic transformation, and this is only the beginning of wheat improvement. Even though transgenic wheat could be a big improvement over traditional, mutation-based, or marker-assisted breeding and selection, it shouldn't be used unless it is clearly better than regular wheat.

Breeders of wheat (Triticum spp.) and barley (Hordeum vulgare) are unable to conduct field tests in future climates because they lack access to future climatic circumstances, and they have no idea which constitutive plant features will be significant in the future, particularly in light of the fast pace of climate change. It is possible that in the future, wheat types that are resistant to high temperatures will be needed at higher latitude regions where most of the world's wheat (Triticum spp.) and barley (Hordeum vulgare) are grown, while drought and salinity tolerance may be the focus of breeding projects in lower latitudes where wheat (Triticum spp.) and barley (Hordeum vulgare) are grown.

Conclusions

Several studies have shown that over the last five decades, conventional breeding has had a significant influence on the production of novel types, such as cross or self-pollinating, and shuffling genetic allelic combinations. There has been an emphasis on yield in traditional breeding techniques, which overlooks other important attributes, including tolerance to natural and man-made stresses. Barley improvement plans are created in order to maintain high and steady yields despite changing environmental circumstances. Cereal breeders are now trying to make their crops more resistant to both natural and unnatural stresses in order to increase yield stability and productivity.

Drought, high temperatures, and other stresses have negative effects on plant physiology, growth, water relations, and production. Additional factors may help determine how drought-tolerant a barley or wheat variety is. The adaptability of barley and wheat to climate change will have a significant impact on future agricultural production systems. Other problems include keeping the improvements in barley and wheat production and making cultivars that grow well in a certain place and can deal with or even survive bad conditions.

The study enables us to make the following conclusions of importance to plant breeding: Conventional and molecular breeding both have an important role in the development of populations that are dynamically responding to climate change. Changes in temperature and rainfall are likely to be different in different places. Climate change isn't just about changes in temperature and rainfall; these changes also affect the spread and outbreak of pests, especially insects, diseases, and weeds. Extreme weather events can also affect how crops and pests interact in unpredictable ways. Climate change is a complicated and always-changing problem that needs a complicated and always-changing solution.

Biological and abiotic pressures may be accommodated by the ability of populations to evolve via natural and artificial selection, so long as they have adequate genetic variety at the outset. This can be a rapid, inexpensive, and flexible solution to a difficult issue. Because traditional plant breeding has been plagued by a lack of acceptance, the incorporation of participatory assessment in the testing of new genetic material such as evolutionary populations makes it simpler to generate innovations more likely to be accepted. This review highlights the idea that the yield stability and quality of wheat (Triticum spp.) and barley (Hordeum vulgare) populations evolving under different microenvironments from a number of different perspectives, making it a specific reference for anyone interested in the yield stability and quality of wheat and barley populations evolving under different microenvironments.

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ثباتية إنتاجية محصول و جودة مجموعات القمح (.Triticum spp) و الشعير (Hordeum vulgare) المتطورة في بيئات صغيرة مختلفة

أمل الخطيب[1] وعمر كفاوين[2] و ستيفانيا جراندو[3]

[1] المركز الوطني للبحوث الزراعية، الأردن
[2] كلية الزراعة، الجامعة الأردنية، عمان، الأردن
[3] أسكولي بيتشينو ، ايطاليا

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ملخص

يتطلب تغير المناخ والنمو السكاني وصحة الإنسان والأمن الغذائي والسلامة والسيادة إعادة النظر في دور التنوع البيولوجي في تربية النباتات. من وجهة نظر بيولوجية، من الممكن أن تكون مجموعات النباتات المتنوعة المتطورة من تطور تربية النباتات قادرة على التعامل مع غالبية هذه القضايا الرئيسية. قد يكون للإجهاد المائي ونقص مغذيات التربة تأثير سلبي على انتاجية ونوعية محصولي القمح (Triticum spp) والشعير (Hordeum vulgare). يجب تطوير أصناف قمح مقاومة للجفاف وذات غلة عالية وإمكانيات جودة عالية ومحتوى بروتين حبوب محسّن إذا أريد الحفاظ على الأمن الغذائي. يعتبر القمح والشعير (Triticum spp. و Hordeum vulgare) على التوالي محور هذا البحث، الذي يهدف إلى فحص ثباتية المجموعات التطورية في مواجهة الظروف المجهدة والمتغيرة. من المهم أيضًا النظر في كيفية أداء المجموعات المتطورة مقارنة مع الأصناف المحسّنة من حيث إنتاجية المحصول ومكوناته. لم يكن هناك تقدم كبير في جعل القمح والشعير أكثر مقاومة للجفاف، خاصة في الأردن، حيث يتم الشعور الأكثر بالمشكلة.

الكلمات الدالة: المجموعات التطورية، القمح، الشعير، تربية النبات، الإنتاجية، الجودة، الثباتية.

* الباحث المعتمد للمراسلة: amalkht@narc.gov.jo