Ecology and adaptation of legumes crops: A review

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**Abstract.** In this review, we discuss the relationship between environmental crop management and adaptation to warming climates of legume plants and plant breeding, for drought tolerance. The benefits connected to the impact of the expansion of appropriate legumes-based agriculture for arid zones are analyzed. We need to two aims to develop
programs of breeding and management guided to drought tolerance. The first one is enhancing productivity. The second one is to improve the drought tolerance by mechanisms of water conservation.

1. Introduction
Hurtful ecological changes significantly affect natural systems, human health, and agricultural output [1]. With the high excess in the world’s population, this is increased in food need due to concerns about the stability of the global environment [2]. Legumes involve one of the largest plant families in the world, with near 18,000 species. Legumes are as source plant proteins for animal and human food. AS well as legumes plants fix atmospheric N\textsubscript{2} and provide cheap and green N fertilizers [3]. The high benefits from the breeding of legumes are the ability to increase inputs of fixed N, for improving the environmental stresses [4,5].

2. Plant Yield and Climate Change
Climate change affects crop production by causes of direct, indirect, and socio-economic effects as defined in Figure 1. Also, climate change events are increased dramatically as related to the Food and Agriculture Organization (FAO) and as described in figure 2. Boyer described that the climate changes had reduced the crop yield up to 70% since 1982 [6,7]. Whereas the outcomes of abiotic pressures on yield are hard to calculate accurately, it is given that abiotic stresses have a significant action on crop production depending upon the class of hurt to the total cultivation area. In the future, the productivity of the main crops is estimated to drop in due to global warming and water shortage [8,9].

![Figure 1. Direct, indirect and socio-economic effects of climate change on agricultural production.](image-url)
3. Crop adaptation to overall extreme climate stresses

With increasing of the Earth’s temperature, environmental changes are extraordinarily damaging and fret hard hazard to different crop species [12,13]. The plants need an optimum temperature for their high growth, and plant physiology is heavily affected by temperature change [14].

Overall, climate change and global warming both have several negative and positive influences on crops as well as on humans, as explained in figure 3. Adaptation of crop plants depends on several factors such as environmental, soil and biotic rather than to a single factor alone. In many situations, one factor (e.g., water availability) may dominate the overcoming conditions, and the nature of the plant’s response then mainly reveals its adaptation to the current level of that aspect. More typically, adaptation is expressed as a response to a mixture of factors and the nature of the response then reflects the plant’s adaptation to the elements in combination. The task of plant breeders is thus difficult and complicated, as they mostly have to develop genotypes with an optimum combination of adaptive characters, rather than noes with a single adaptive character [15]. Whatever the increasing conditions, the critical consideration is the nature of the adaptive plant response itself and, for business purposes, the outcomes of that response in terms of the economic output of the yield. For example, a plant that grows good under a specific set of conditions, but weakens to flower and set seed, is of little value as a grain crop in that condition. It may, however, be an excellent forage crop under those situations, as the commercial product is not needed on flowering and seed set [16].

The conception of adaptation can be challenging to identify, as it is applied in respect to both the evolutionary origins of a character and its influence to the fitness of the plant to survive in its present setting. Adaptation is also heritable, i.e., it is defined by the genotype of the plant. Hence the definition can be improved to ‘the heritable modifications to a plant which enable it to survive, reproduce, or both, in a given condition’ [17].
4. Plant adaptation to drought stress

Drought stress is the whole dominant environmental issue limiting crop production [18] and global climate change is enhancing the frequency of severe drought conditions [19,20]. Drought resistance is a wider idiom used to plant species with adaptive aspects that can help them to bolt or endure drought stress [21]. Drought escape is the capability of plant kinds to finish its life cycle before the starter of drought. Thereby, plants do not experience drought stress, as they are capable of amending their productive growth according to water availability [22,23].

Most of the attempts to improve grain yield under drought stress were concentrated on secondary traits such as root architecture, leaf water stress, osmotic adjustment, and relative water content at the vegetative stage, which are often not highly associated with grain yield [24]. Looking forward to crops, the effective drought development methodology should be chosen for yield and its component traits under reproductive-stage drought stress [10,25]. There occurs a large variety in drought adaptation within a crop species, as some genotypes are adept at coping with drought better than others. Genotypes that differ in drought adaptive mechanisms operate as an important supply to survey the difference in drought adaption in plants [11].

5. Actual and potential possibilities for legume crops breeding based on ecological traits

As respects to the research of options for the development of a selection or breeding program adapted to drought, according to Kelly [26] strategies utilized by dry bean breeders to improve yield involve early generation testing, ideotype breeding, choice for physiological efficiency, and selection based on genotypic performance and blending ability across gene pools of Pharsalus Vulgaris. Ideotype breeding has been successfully employed to enhance yield in navy, pinto and great northern seed types. The ideotype method is based on an ideal plant architecture to which breeders object their selection.

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