

Innovations in Plant Breeding as a smart and cost-effective solution for fast adaptation to climate change: studies with barley and cowpea

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Investments in plant breeding are seen again (after the era of green revolution) as an important and cost-effective means to tackle climate change and improve food security, particularly in unfavorable environments. It is widely accepted that global food production has grown faster than population over the last century, due principally to the product of plant breeding, *i.e.*, improved varieties. However, there are valid concerns that this is no more the case and the reasons are not merely attributed to population growth - climate change has also a pivotal role in the observed yield gap. Plant breeding under climate change resembles a continuous pursuit of fast-moving targets. The great challenge for the plant breeder is to increase the efficiency of the breeding process and to capture the newly generated adaptive variation, so that newly adapted plant genotypes are developed as fast as necessary to match the changing micro-environments. As a reference point, improvements in global crop yields, averaged over many decades, are usually less than 1% per year, regardless of the crop species in question.

The paper presents 3-year data of experiments on barley and cowpea, two important annual Cyprus crops, and the progress that has been achieved in this relatively short time compared to the slow pace of breeding process (e.g., the average time frame for a cereal cultivar development is usually 10-14 years). The starting materials are both landraces and modern cultivars. The novel experimental methodology used capitalizes in field selection in the absence of the masking effects of interplant competition and soil heterogeneity, aided by innovative field designs and prognostic selection equations, highlighting the great, still untapped, potential that exists for fast plant adaptation to the changing environments.

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