Sustainable stewardship of the landrace diversity in legumes

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Landraces of legumes are preferably grown under low input conditions thanks to higher stability, i.e., regardless of the varying stresses, one or more genotypes will yield satisfactorily. Nevertheless, naturally evolving landraces may lose their identity and healthiness in the long term, due to contaminating and degrading forces. A pilot scheme is provided that entails the manipulation of the landrace diversity through bulk or mass selection, with the aim of establishing perpetual adaptation to an ever-changing environment [1,2].

Implicative key assumptions that led to the proposed conservation breeding procedure were: (i) Endogenous molecular mechanisms of new genetic variation expand the landrace heterogeneity adding desirable and deleterious mutations. (ii) Due to plant-to-plant dissimilarity within the crop stand, ineffective resource use is the outcome of the unbalanced growth of individuals. (iii) Intra-species competitive ability is inversely connected with yielding capacity, thus constituent genotypes of high-yield capacity are those of the 'weak-competitor' ideotype. (iv) Under intra-species competition strong competitor–low yielders prevail masking the yielding capacity of weak competitor–high yielders. (iv) Landrace evolution under inter-species competition may gradually lead to seed degradation from preferential and gradual proliferation of the low yielders at the expense of high yielders.

The procedure aims to replenish the seed, partly to be kept as stock, and the remaining to feed the multiplication rounds (Figure 1). About 2000 plants are grown at *nil*-competition in a honeycomb trial [3]. As an option, the stock seed is used as the check so as to facilitate detection and removal of the "off-type" plants. Seed yield of the remaining plants is recorded. Placing each individual plant in the center of a ring, its absolute yield, x, can be expressed in relation to the average yield of the ring (i.e., the moving circle replicate), resulting in the unitless that measures the relative plant yield efficiency devoid of the confounding effect of spatial heterogeneity. A number of 35-15% plants of the landrace type are selected, on the premise that their relative yield efficiency is above one, >1, and their seed is mixed. The procedure may represent an effective cultural practice to improve the landrace yield and health status concerning seed-borne or soil-borne diseases in the absence of certification systems, and such case studies have been made in lentil [4,5]. A new relative project is now under way (see Acknowledgment).

The scheme also offers the possibility to draw new varieties for registration. By considering only the top selected plants, a multigenotypic variety will result. Multigenotypic varieties may deserve more room henceforth due to the enormously varying environment. Moreover, and particularly for the self-pollinating species, by considering single-plant progeny lines, pedigree breeding may result in highly yielding pure-line varieties. Such case studies have been conducted in lentil [6] and common bean [7].

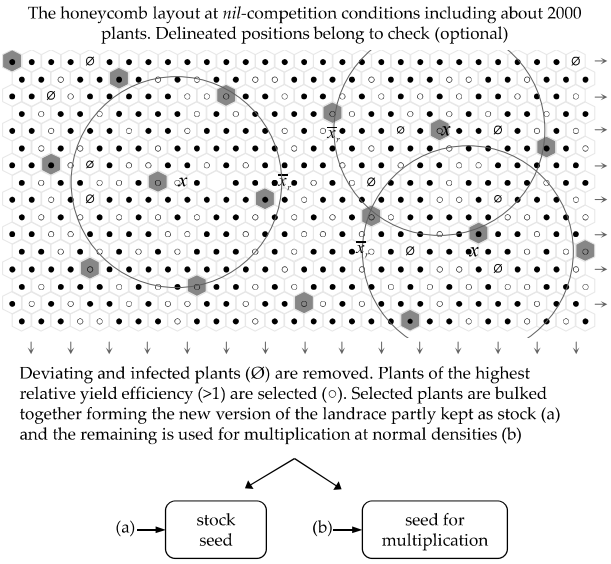

Figure 1. A pilot scheme of the landrace bulk breeding at *nill*-competition leading to upgraded seed [1]

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