The culture of purity in 20th century plant genetics
An archaeology of « DUS–centralized–delegatory–"wide adaptation" –High input » breeding paradigm

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Abstract

It seems evident to all participants of this meeting that the right way to go for 21st century plant breeding is best characterized by the right column, whereas the 20th century dominant way is on the left column of this table:

« DUS–centralized–delegatory–"wide adaptation"–High input » breeding paradigm	*« Evolutionary-decentralised-participatory-"specific adaptation"-low input » breeding paradigm*
DUS The best and most predictable cultivars are genetically homogeneous (fixist vision).	Cultivars can be genetically homogeneous (if the users find it necessary) or heterogeneous (evolutionary breeding for homeostasis)
Only specialized professional plant breeders in well equipped agricultural stations are able to produce robust reliable knowledge: - (centralization) the station is the best place for gathering, creating, caracterizing and selecting variability because its space can be ordered so as to separate genotype effects from environment effects. - (delegation) Producing robust data requires scientific and technical skills beyond the grasp of farmers: artificial crosses, mendelism (then quantitative genetics), experimental protocols, statistical analysis…	Although the station (with specialized skills) is a convenient place to gather and produce variability, its caracterization and the selection is more efficient if: - run in the target environment. The centralized breeding is now labelled as "indirect selection" - mobilizing the knowledge of target users ("farmers-assisted selection")
Breeding for uniform uses (standardisation, scale economies) Modernizing agriculture means having only a few elite "widely adapted" cultivars in each country.	Breeding for diversity (learning economy, variety economy) Plant breeders should breed for specific adaptations (local peaks of G x System x E interactions). Modern varietal innovation means tailor-made breeding until achieving optimal adaptation to "each individual field" (Murphy and al. 2005)
High input agriculture is the best condition to get the best yield from the best elite cultivars.	Low input agriculture requires specific breeding efforts, both in the North (organic farming) and in the South (poor farmers, marginal conditions)
The role of professional breeders: providing homogeneous elite cultivars to farmers as end-users	The role of professional breeders: providing variability [including smartly designed heterogeneous bulks] to farmers as co-innovators

As an historian of science & technology, my research project for the next years is to tell the story[1] of this paradigmatic shift in plant breeding and genetics both in the North and in the South. How is it that robust facts and relevant cultivars, that were (in the 20th century) thought to require purified and ordered spaces in the station and esoteric skills of geneticists, are now seen to be better achieved on farm with the help of farmers' knowledge and practices ?

But this is only a beginning project, and it is impossible now to give the full story, but rather only preliminary results. The paper will sketch a kind of archaeology of the « DUS–centralized–delegatory–"wide adaptation"–High input » breeding paradigm. It will investigate the quest for purity in plant genetics from Louis Pasteur's "cultures pures" to Johannsen's claim that « the study of the behavior of pure lines is the basis of the science of heredity » (Johannsen, 1903, 9) and to the establishment of Distinction Uniformity Stability (DUS) norms. The paper will show how the five key features of 20th century plant breeding and genetics dominant paradigm [i.e. 1) the fixist varietal norms (purity, DUS), 2) the centralization of breeding, 3) its delegatory character, 4) the search for wide spatial adaptation cultivars and 5) the focus on breeding in/for High-input systems] were strongly interconnected and formed a coherent whole. It will also point at research traditions in genetics, that were outside the paradigm of purity and remained marginal in 20th century plant breeding, but which are now at the roots of a rising « Evolutionary-decentralised-participatory-"specific adaptation"-low input » breeding paradigm.

[1] A story of ideas and theories of course, but also of markets an states, power struggles and imaginaries…