

## Progress in rapeseed research<sup>☆</sup>

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Rapeseed research has benefitted over recent years from a range of major stimuli. Every four years, from each conference to the next, the GCIRC congress highlights these advances, as Pilorgé *et al.* (2019) explained in their review of the Saskatoon 2015 Conference looking ahead to this year's Berlin meeting. I underlined it in June in my concluding remarks at the end of the 15th GCIRC Congress 2019, in which I presented an overview of the key highlights of this congress for rapeseed and canola research: "Regarding the topics of genetics, genomics and breeding, numerous approaches and technologies for investigating the oilseed rape and Brassica genomes that did not even exist at the last congress have been established in recent years and are now being applied. A good example is the sequencing of long reads, which has enabled the discovery of large and small scale genome structural variation in an unprecedented detail. It is providing us with a wonderful opportunity to understand chromosomal rearrangements or cytoplasmatic evolution with a view to improving traits. If someone had said some years ago that we would soon be able to sequence several hundreds and even over a thousand entire rapeseed genomes in an instant, few would have believed it. The new techniques are enabling the community to rapidly push the Pan Genome approach forward, thereby creating an extremely powerful data source to unlock the secrets of trait inheritance. This information will be a solid foundation for understanding further the complex regulation of relevant traits. At a time when sequence information is doubling every few months, there is surely still much to expect from this field in the future. But the mere description of DNA information is not enough: establishing the links to traits, *i.e.* agronomic or quality characteristics, will we make all of the thousands of terabytes of sequence information useful. In this regard, it is pleasing to observe that improved understanding of plant genomes can make a significant contribution to breeding progress. In particular, contributions towards understanding hybrid vigor, the development of heterotic pools and the expansion of genetic pools and new approaches to predictive breeding have been addressed."

To illustrate breeding, this OCL's issue proposes an article about development and evaluation of diverse promising rapeseed (*Brassica napus L.*) mutants using physical and chemical mutagens (Channaoui *et al.*, 2019a).

Agronomy is also a major subject of rapeseed research. The 2019 GCIRC congress has probably been as much in within the context of climate change as no other congress before. The increasing frequency of extreme weather events makes us wonder whether and how rapeseed farming needs to be reshaped in the future. Although not every drought and every hot summer is attributable to climate change, on almost all continents weather extremes have increased and somehow caused yield losses. In addition, the emergence of increasing environmental standards – for example to avoid nutrient (N) surpluses with their consequences on ecosystems and drinking water – put further pressure on justifying the achievement of high yields against their costs to the environment. To illustrate these two main points, three articles specifically focus on drought, waterlogging and thermal stresses: the first one focusing on reaction of some rapeseed (*Brassica napus L.*) genotypes to different drought stress levels during the stages of germination and seedling growth (Channaoui *et al.*, 2019b); the second one assessing a set of rapeseed (*Brassica napus L.*) varieties under waterlogging stress at different plant growth stages (Nabloussi *et al.*, 2019); and the last one dealing with the effect of selenium foliar application on oil yield, FA composition and glucosinolate content of rapeseed cultivars under late-season thermal stress. In addition, a French team published its results about how to value in France varieties with higher nitrogen use efficiency (Charbonnier *et al.*, 2019).

Another feature of the 2019 GCIRC congress has been the designation of a special session on mustards, reflecting their importance especially on the Indian subcontinent. I am not sure if this "experiment" can be considered as a success. Rather, it deserves further consideration *e.g.* by the organizers of the coming IRC. In any case, this special issue of OCL also includes an article dealing with oilseed brassica in India: its demand, supply, the policy perspectives and future potential (Jat *et al.*, 2019).

Finally, since a particular feature of OCL is that it covers the entire sector from field to plate, the topic of nutrition naturally arises. Going from seeds to oil, issues surrounding extraction had to be questioned. An article in this issue investigates whether alternative solvents, ethanol and isopropanol, could replace hexane and enhance the quality and value of oil and meal (Citeau *et al.*, 2019). A second article addresses kinetics and effects of type of solvent and microwave-pretreatment on ethanol extraction of canola oil (Sánchez *et al.*, 2019).

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Changing consumer behavior is leading to a significant rise in demand for vegetable protein products and is opening more opportunities for OSR than ever before. This leads me to strongly believe that OSR will have indeed a flourishing future in the feed and the food area and beyond.

Major prerequisites for such a wishful development include:

- better exploitation of yield potential in terms of farm yield *via* better adaptation of cultivars to abiotic stress and pathogens (*i.e.* complementation of chemical and biological approaches);
- development of resilient agro-ecosystems by increasing crop diversity and improving crop rotations (*i.e.* diversification of cereal-centered agrosystems);
- increase the added value of oilseed rape/canola *via* better exploiting the existing and potential diversity of valuable ingredients inside the rape seeds; *e.g.* improve and use rapeseed protein as a valuable alternative to animal protein.

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