



FACULTÉ
DES SCIENCES

UNIVERSITÉ LIBRE DE BRUXELLES



Exploiting the genetic diversity of rapeseed (*Brassica napus* L.) root morphology to improve nitrogen acquisition from soil

Thesis submitted by Julien LOUVIEAUX

in fulfilment of the requirements of the PhD Degree in Agronomy and Bioengineering (“Docteur en Sciences agronomiques et ingénierie biologique”)

Academic year 2020-2021

Supervisor: Christian HERMANS

Crop Production and Biostimulation Laboratory

Thesis jury:

Michel VAN KONINCKXLOO (Université libre de Bruxelles, Chair)

Marjolein VISSER (Université libre de Bruxelles, Secretary)

Xavier DRAYE (Université catholique de Louvain)

Christian HERMANS (Université libre de Bruxelles)

Dirk REHEUL (Universiteit Gent)

Table of contents

Abstract	I
Acknowledgements	III
List of abbreviations.....	V
Scope and objectives of the thesis	1
1. General context	4
1.1. Towards an ecologically sustainable intensification of agricultural production systems	4
1.2. The challenge of improving Nitrogen Use Efficiency in crops	5
1.3. Biology and culture of oilseed rape.....	6
1.4. Influence of nitrogen on root morphology	9
1.4.1. The nitrate influence on the root morphology of <i>Arabidopsis thaliana</i>	10
1.4.2. The molecular identification and functional characterization of nitrate transporters in <i>Arabidopsis thaliana</i>	12
1.4.3. Premises on ideal root architectural attributes to optimize nitrate acquisition in oilseed rape	13
2. Relations between root morphology at a young development stage and field performance	15
2.1. Setting-up a high-throughput screen procedure for root morphology in laboratory conditions.....	15
2.2. Article.....	19
3. In-field root observation	38
3.1. Article.....	42
4. Identifying key genes in root development	56
4.1. Article.....	57
5. General discussion and perspectives.....	75
6. References	88
7. Supplemental material	111