Plasticity of winter wheat modulated by sowing date, plant population density and nitrogen fertilisation: Dimensions and size of leaf blades, sheaths and internodes in relation to their position on a stem

Titre	Plasticity of winter wheat modulated by sowing date, plant population density and nitrogen fertilisation: Dimensions and size of leaf blades, sheaths and internodes in relation to their position on a stem
Type de publication	Article de revue
Auteur	Dornbusch, Tino [1], Baccar, Rim [2], Watt, Jillian [3], Hillier, Jonathan [4], Bertheloot, Jessica [5], Fournier, Christian [6], Andrieu, Bruno [7]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2011
Langue	Anglais
Date	2011/02/28
Numéro	1
Pagination	116 - 124
Volume	121
Titre de la revue	Field Crops Research
ISSN	0378-4290
Mots-clés	Internode [8], Leaf blade [9], Plant population density [10], Plasticity [11], Sheath [12], Sowing date [13], Stem height [14], Triticum aestivum [15], wheat [16]

Résumé en anglais	Mathematical models to describe crop–environment interaction on organ scale need to take crop or plant architecture into account. Up to now, architectural plant models are largely descriptive and parameters need to be estimated for each species, cultivar and environment. Required measurements are extensive and time-consuming. Hence investigating morphological patterns and their modulation as a response to environmental conditions may help to reduce measurement efforts and to predict plant architecture in crop models. In this paper, we describe the plasticity of winter wheat – expressed as the dimensions and sizes of leaf blades, sheaths and internodes in relation to their position on a stem – under the climatic conditions of the Paris region. Results are discussed with respect to: (i) genotypic variability, (ii) inter-annual variability, (iii) sowing date and plant population density, (iv) Nitrogen fertilisation and (v) tiller rank.Eight wheat cultivars grown in the same season showed similar patterns of leaf and internodes dimensions in relation to their position on the stem. For the cultivar 'Soissons', main stem architecture at flowering was remarkably stable when similar growth conditions were reproduced in the different seasons. Increased plant population density yielded longer juvenile, but shorter adult leaf blades and sheaths. Earlier sowing led to an increase in the number of juvenile phytomers – growing before the onset of stem elongation – on the main stem, whereas the number of adult phytomers was almost identical. Further there were little differences in the size of leaf blades, sheaths and internodes between the main stem and axillary tillers. We found remarkable differences in the size of adult leaf blades and sheaths in different growing seasons, with different timing of nitrogen fertilisation and we discuss decreased availability of nitrogen in the soil in spring as a likely cause. Data presented here can be used to enlarge the understanding of wheat plasticity regarding the regulation of organ size by temperature, light, plant-available nitrogen and size-mediated effects towards a mechanistic modelling of these responses.
URL de la notice	http://okina.univ-angers.fr/publications/ua7737 [17]
DOI	10.1016/j.fcr.2010.12.004 [18]
Lien vers le document	http://dx.doi.org/10.1016/j.fcr.2010.12.004 [18]

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[18] http://dx.doi.org/10.1016/j.fcr.2010.12.004