



PPP Project Annual Report 2018

The PPP-projects that have been established under the direction of the top sectors must submit an annual report on their technical and financial progress. This format is to be used for reporting the technical progress. A separate format ('PPP final report') is available for PPP-projects that have been completed in 2018.

The annual reports will be published in full on the websites of the TKIs/top sector, excluding the blocks 'Approval coordinator/consortium' and 'Planning and progress'. Please ensure that no confidential matters are left in the remaining blocks.

The PPP Project Annual Reports must be submitted to the TKI's before March 1st 2019. For Wageningen Research this will be coordinated via a central point.

General information	
PPP number	KV 1605-058
Title	<i>Improving fertility and seed set in Chrysanthemum</i>
Theme	Better plants for new demands
Executive knowledge institution(s)	Wageningen Plant Research, Bioscience
Research project leader (name + e-mail address)	Prof. dr. Richard G.H. Immink
Coordinator (on behalf of private parties)	Dr. Nick de Vetten, Dekker Chrysanten
Government contact person	Annet Zweep
Total project size (k€)	448
Address projectwebsite	-
Start date	01-01-2018
End date	31-12-2021

Approval coordinator/consortium	
<i>The annual report should be discussed with the coordinator/the consortium. The TKIs appreciate being informed of possible feedback on the annual report.</i>	
The coordinator has assessed the annual report on behalf of the consortium:	<input checked="" type="checkbox"/> approved <input type="checkbox"/> rejected
Possible feedback on the annual report:	

Planning and progress (if there are changes to the project plan, please explain)	
Is the PPP going according to plan?	Yes
Have there been changes in the consortium/project partners?	No
Is there a delay and/or deferred delivery date?	No
Are there any substantive bottlenecks? Provide a brief description	No
Are there any deviations from the projected budget?	No

Short content description/aim PPS

What is going on and how is this project involved?
 What will be delivered by the project and what is the effect of this?

The Netherlands is the top exporter of cut flowers and Chrysanthemum represents the second most important cut flower in the world. This position is threatened by low-cost countries that are lurking to take over the market, urging Dutch breeders to search for even more efficient breeding methods. The most important problem that Chrysanthemum breeders are currently facing is the ever decreasing seed set of popular ornamental varieties, resulting in a very low seed yield after crosses. In this project we are aiming at:

- I. Obtaining fundamental knowledge about the genes and processes involved in formation of the reproductive organs and determining seed set in chrysanthemum.
- II. Identification of the genetic basis of severely reduced seed set in ornamental varieties.

Advances in vegetable breeding have been made possible by molecular research and the same techniques can speed up breeding in the ornamental world. The use of molecular markers can predict which parents can produce offspring with certain traits and, more importantly, select seedlings at an early stage to determine which of them possess the desired trait(s). This project will deliver detailed insight in the genetic mechanisms determining reproductive organ development and seed set in Chrysanthemum and will provide the basis for marker-assisted breeding for optimal seed set. Additionally, an employee of the private partner will be educated at PhD level.

Results in 2018/ so far

Give a short description of the high-lights and project deliverable in 2018 / so far

1. Detailed study of chrysanthemum flower morphology. Chrysanthemum is a composite and its flower head consists of ray and disc flowers. Decorative varieties contain a high number of ray flowers, which have high ornamental value, but very low fertility. To shed light on the exact cellular and morphological cause of this strongly reduced fertility, phenotyping of chrysanthemum flower development was performed at the microscopy level in varieties with good and poor seed set. These analyses revealed that the reduced, or lack of ray flower fertility is in general not due to lack of reproductive organ primordia, but because of an arrest during later developmental stages of these primordia. As a consequence, carpels are formed that are not completely fused and that (partially) lack receptive stigmatic tissues. Pollination of these miss-formed carpels resulted in reduced or no pollen tube growth and a lack of fertilization and seed set.
2. Determine which genes are differentially expressed between the different flower types. Flower development was studied in detail in two varieties with high number of ray flowers, for which corresponding mutants were available with an increased number of disk flowers. Subsequently, qPCR was done to study the expression of a small selection of marker-genes supposed to be associated to identity and outgrowth of the reproductive organs. Based on this analysis, the variety and corresponding mutant with the largest differential expression of the marker-genes was selected. Additionally, the best time points were selected to be investigated by RNAseq. This genome-wide transcriptome analysis was performed successfully for three early stages of flower head development in the selected variety and corresponding mutant. Currently, detailed data analyses are done, aiming at the identification of candidate genes associated to flower fertility.
3. QTL analysis to identify causal loci. The results of activity one described above showed that the ratio disk-ray flowers and the quality of the pistil are important determinants of fertility in chrysanthemum. In order to score for these two traits, various phenotyping methods will be tested to quantify pistil quality. These analyses are in progress and the most reliable and easy to perform assay will be used in the near future to phenotype a QTL-population.

Number of delivered products in 2018 (in an appendix, please provide the titles and/or description of the products or a link to the products on public websites)

Academic articles	Reports	Articles in journals	Introductions/workshops
0	0		

Titles/ description of the most important products in 2018 (5 at max) and their target group
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Appendix: Names of the products or a link to the products on a public website including the link to the project summary on Kennisonline