

# THE CROWN ROT ‘DEADHEAD’ PHENOMENON IN DURUM WHEAT

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## INTRODUCTION

Crown rot of wheat, caused by *Fusarium pseudograminearum* (*Fp*), is a serious disease threat across the Australian wheat belt, particularly in durum wheat. Control of this disease is primarily based on crop rotations and reducing inoculum, with a continued goal of producing crops with increased resistance. Plant reactions to disease are typically described using stem browning, sometimes coinciding with the production of ‘deadheads’, or stems undergoing premature senescence due to infection.

The mechanism by which crown rot causes yield loss has not yet been clearly described, however evidence is emerging indicating fungal blockage of both xylem and phloem tissues (1). It would be logical to infer that ‘deadhead’ stems had more *Fp* biomass and greater vascular tissue colonisation, resulting in their premature death. It must, however, be demonstrated. The information gained by examining ‘deadheads’ may be applied to less extreme infections as an explanation for the physiological effects behind crown rot associated yield loss.

The idea behind this experiment was to investigate the levels of colonisation of stems of durum plants exhibiting ‘deadheads’ in the field and compare these to stems of the same plants which were still living. Microscopic assessment of stem sections is also planned.

## MATERIALS AND METHODS

**Plant Materials** Durum variety EGA Bellaroi was grown in *Fp* inoculated fields at Wellcamp, Qld. Plants were selected based on ‘deadhead’ expression, where a single plant was exhibiting a ‘deadhead’ and a living stem for comparison. Three data sets were collected across 3 years using approximately 30 plants each.

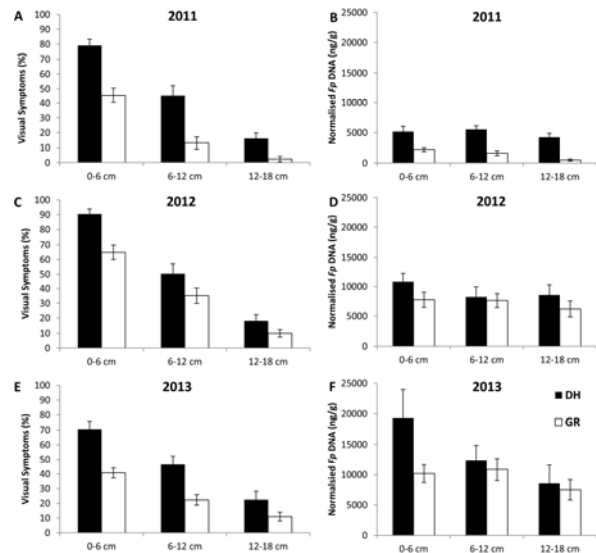
**Stem Sections** Three 6 cm sections were taken from the base of each stem, and the 6 cm of the peduncle below the head was also collected. Visual rating was performed and DNA was then extracted for quantitative PCR analysis (2). The *Fp* biomass was compared between sections from ‘deadhead’ stems and living stems.

## RESULTS AND DISCUSSION

In general, visual symptoms and the amount of *Fp* biomass decrease from the basal 0-6 cm section to the 12-18 cm section. Initial results indicate that ‘deadhead’ stems usually have greater levels of visual symptoms than the infected living stems, however *Fp* biomass is not necessarily higher in ‘deadhead’ stems (Figure 1).

The data demonstrates a wide range of colonisation levels, both between ‘deadhead’ stems and living stems and within these groups. This is likely due to different stages of infection occurring simultaneously in the field, which cannot be distinguished using traditional visual methods. Differences in infection levels between seasons are also highlighted using *Fp* biomass measurements. These differences are not apparent using the visual rating system.

The top 6 cm of the peduncle has also had low, but detectable, levels of *Fp* in approximately 30% of stems. At this time this shows no association with stems which are either living or ‘deadheads’.



**Figure 1.** Visual symptoms (%) and *F. pseudograminearum* (*Fp*) biomass (ng/g) of ‘deadhead’ (DH) and living (GR) stems of EGA Bellaroi in 2011 (A,B), 2012 (C,D) and 2013 (E,F). Three sections from 0-6 cm, 6-12 cm and 12-18 cm were collected from each stem. Bars represent the standard error.

Experiments are continuing on two further collections of durum plants from 2014, as well as several sets of bread wheat plants. This will include microscopic comparisons of vascular bundle colonisation in sections from ‘deadhead’ and living stems. The stem portion between 18 cm and the peduncle has also been retained for examination of fungal spread along a stem when *Fp* is detectable to the upper portion of the peduncle.

These experiments are yielding interesting information on the biology and potential physiology of the crown rot disease system.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. Knight, N. L. and Sutherland, M. W. (submitted). Histopathological assessment of *Fusarium pseudograminearum* colonisation of cereal culms during crown rot infections.
2. Knight, N. L., and Sutherland, M. W. (2015). Culm discolouration as an indicator of *Fusarium pseudograminearum* biomass. Australasian Plant Pathology