

# THE EFFECT OF INCREASED SOIL ORGANIC MATTER ON SEVERITY OF DISEASE CAUSED BY *RHIZOCTONIA SOLANI* AG3 ON POTATO

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## Introduction

Some previous studies have reported that the incorporation of organic matter (OM) into field soil results in a decrease in crop disease severity caused by soil-borne pathogenic fungi. Conversely, others have reported an increase in disease severity; see review by Noble (2011). This is thought to be due to differences in the composition of the organic matter which may possess antagonistic properties and thus repress disease, or alternatively provide a substrate for increased pathogen growth. In this study we investigated the effect of incorporating additional soil organic matter into field soil infested with *Rhizoctonia solani* AG3 (hereafter referred to as *R. solani*) on crop emergence and subsequent yield and disease on progeny tubers. In an ongoing complementary study, the effect of soil OM on the survival of *R. solani* in soil through a 6 year rotation and its impact on disease severity on potato crops is being investigated



## Methods

### Field Trial

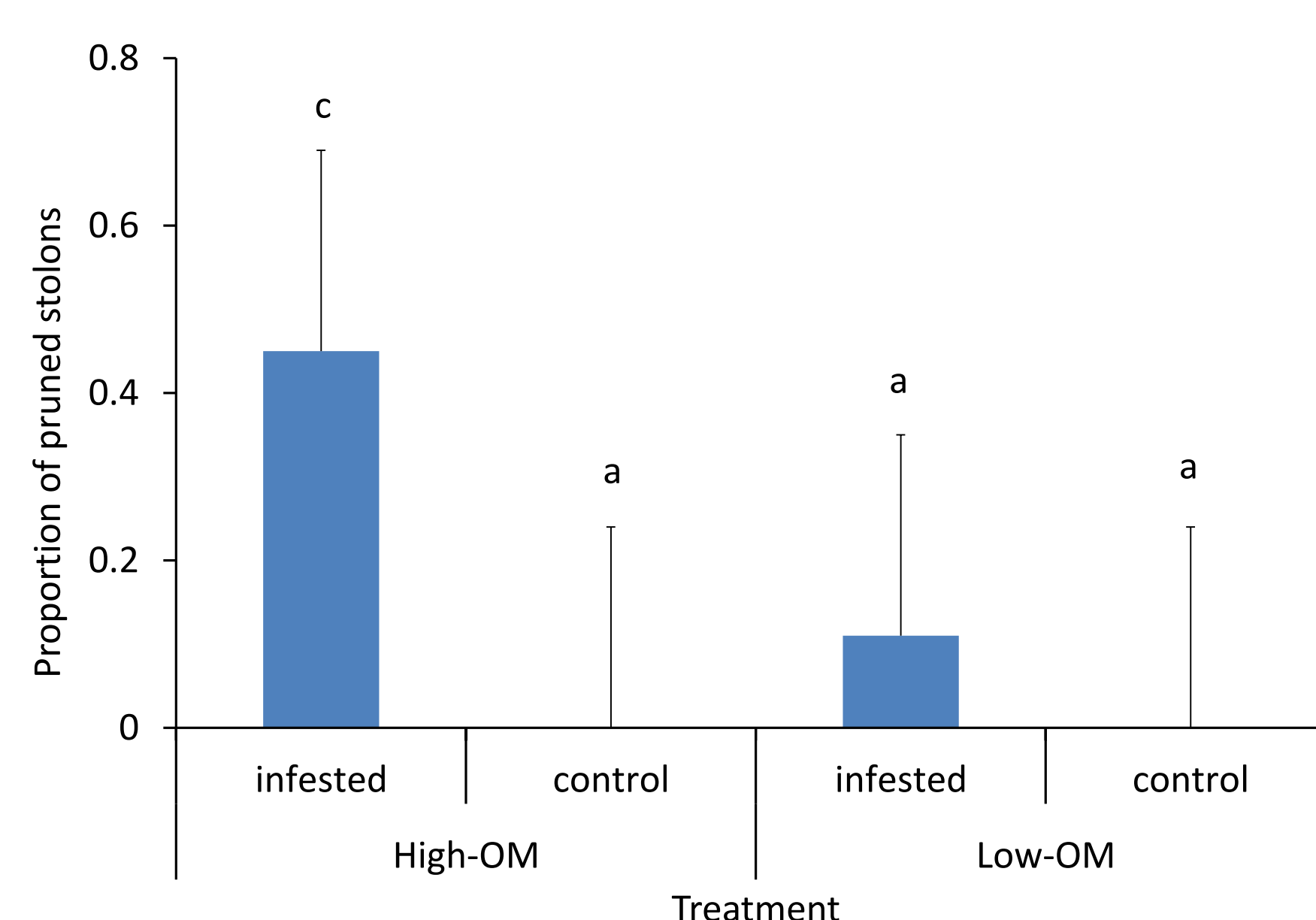
A field naturally low in OM was selected. A split plot design was used, with high and low OM areas of the field as main plots. A high level of soil OM was achieved by the incorporation of cattle manure mixed with barley straw (approximately 35 t/ha) which increased the OM from 0.2 to 0.5 g per kg. Within each main-plot, plots were either infested with *R. solani* or un-infested (control). To infest plots, potato dextrose agar (PDA) plates were inoculated with an isolate of *R. solani* and incubated in the dark at 20°C for 6 weeks. Sclerotia were removed from the plates and mixed with vermiculite before spreading along each of the prepared drills at planting. There were four replicate blocks.

Mini-tubers of cultivar Markies were planted to eliminate the possible effects of seed-borne inoculum on the crop. Crop emergence was recorded at intervals of 3 to 4 days from 4 weeks after planting. Mid-season (14 weeks after planting) a single plant per plot was carefully dug up and the number of stems, stolons and pruned stolons recorded. At final harvest, yield, tuber size distribution and the surface area of progeny tubers with black scurf symptoms was recorded.

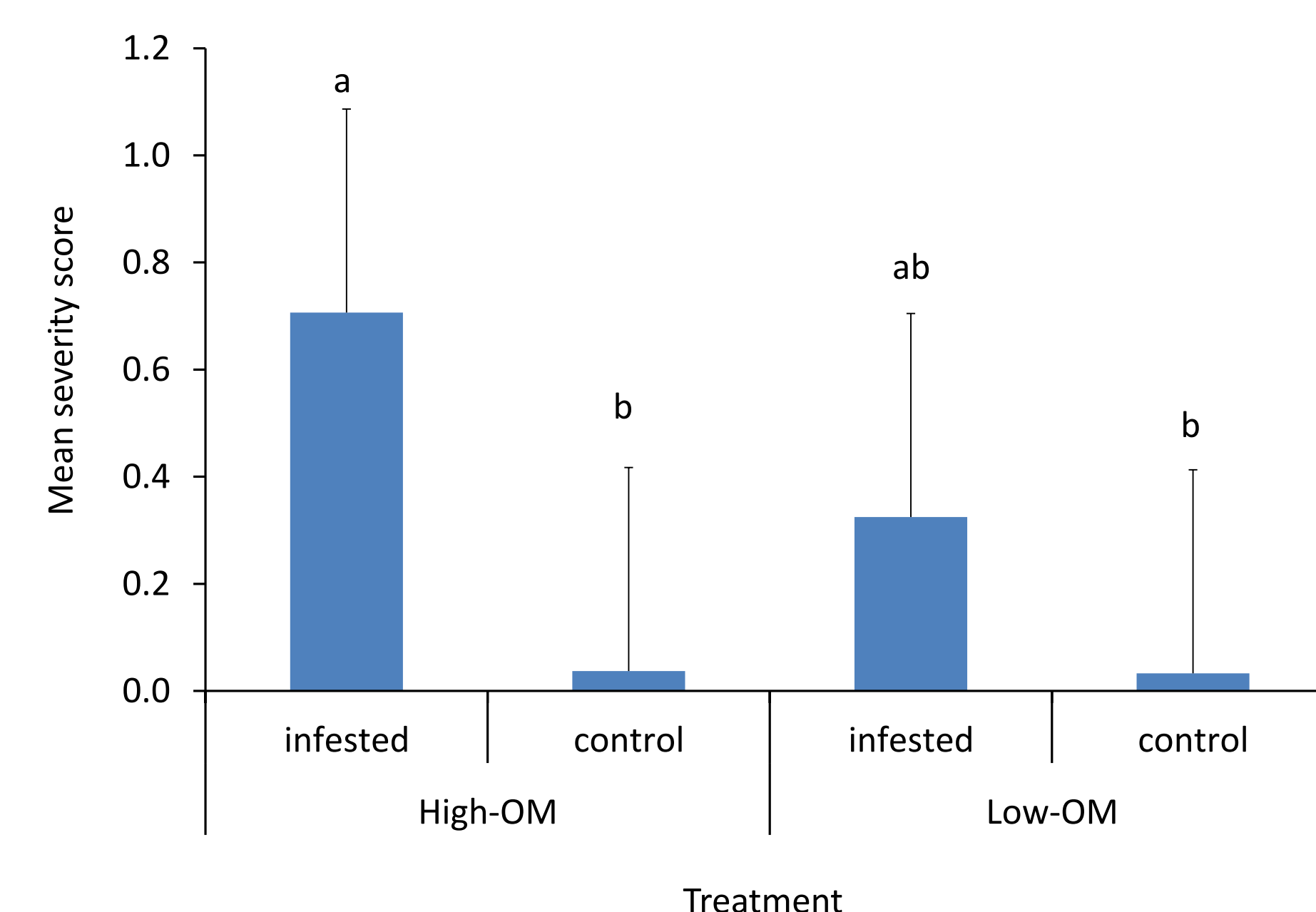
## Results

In plots infested with *R. solani* to which additional OM (barley straw and manure) had been incorporated:

- ❖ Emergence was delayed:  
In controls (both low- and high-OM plots) 90% emergence was reached 5 weeks after planting but increased to 7 and 11 weeks in infested plots with low and high OM respectively.
- ❖ Incidence of stolon pruning increased:  
In *R. solani* infested treatments, the proportion of pruned stolons was significantly higher ( $P < 0.05$ ) in plots with high OM than in plots with low OM (0.45 and 0.11 respectively) – Figure 1.
- ❖ Yield decreased:  
Yield reductions reflected the differences in the time taken to emerge between treatments, if the crop had been left in the ground longer the impact on yield may have been reduced.
- ❖ black scurf on progeny tubers increased:  
Additional soil OM significantly increased the incidence (45% cf. 19%;  $P < 0.05$ ), but not the severity, of Black scurf on tubers grown in *R. solani* infested plots – Figure 2.



**Figure 1** The effect of soil infestation with *R. solani* and the level of OM on the proportion of pruned stolons –mid season sample (mean of four replicates; bars represent 1sd). Treatments not sharing the same letter are significantly different ( $P < 0.05$ ).



**Figure 2** The effect of soil infestation with *R. solani* and the level of OM on the severity of black scurf on progeny tubers at final harvest (mean of four replicates; bars represent 1sd). Treatments not sharing the same letter are significantly different ( $P < 0.05$ ).

## Conclusions

In this field trial, the addition of organic matter to soil infested with *R. solani* caused an increase in disease associated with both early season infection (delayed emergence and stolon pruning) and late season disease symptoms (black scurf on progeny).

However, other reports have been made of increased OM resulting in reduced disease associated with *R. solani* infestation. Disease suppression has been attributed to both abiotic factors such as the release of volatiles and biotic factors such as microbial antagonism or induced plant resistance.

Noble R (2011). Australasian Plant Pathology 40: 157-167

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