PLANTING DENSITIES AFFECTING WHITE MOLD INCIDENCE AND SEVERITY, AND COMMON BEAN YIELD

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Introduction

White mold (*Sclerotinia sclerotiorum*) is a serious disease of common beans in irrigated areas of Minas Gerais State, Brazil, during the fall-winter growing season. Beans are planted in rows spaced 0.5 m apart with 10 to 15 seeds per meter. However, some farmers use narrow row widths and/or up to 20 seeds per meter. It is known that low temperature, high humidity and wet plant canopy and/or soil surface favor pathogen spread. Therefore, wider row spacing and/or lower plant population can provide less favorable environmental conditions to white mold because of better light penetration into plant canopy and soil, and increased ventilation. Nevertheless, the effects of this technique on bean yield have not been quantified. The objective of this research was to quantify white mold intensity (incidence and severity) and bean yield using different planting densities.

Material and Methods

A trial was installed in Viçosa, Minas Gerais State, on 26 May 2001 in a field naturally infested with sclerotia of *S. sclerotiorum*. Bean cv. Pérola (type III) was sown in rows spaced 0.5 m apart. Treatments were four levels of planting densities: 4, 8, 12, and 16 plants per meter, with or without fungicide (fluazinam). At planting, a high seedling rate was used to ensure that enough seeds would germinate. Ten days after emergence (DAE), seedlings were thinned to the desirable planting densities (initial stand). Fluazinam (0.5 L ha^{-1}) was applied at 45 and 55 DAE with 667 L ha^{-1} of water. At 45 DAE, 40% of plants had at least one open flower. The trial was laid out on a randomized complete block design with six replications. Each plot had four 5m-long rows. Weeds were chemically controlled with metolachlor (preemergence) and after emergence with fomesafen + fluazifop-p-butyl. Insects were controlled when necessary. Weekly plants were sprinkler irrigated with a volume of 50 mm of water. An area of 1 m^2 of each plot was separately harvested for disease assessment and quantification of bean yield components. White mold severity was assessed using a rating scale of grades 0, 1, 2, 3, and 4 which correspond to 0, 1-25, 26-50, 51-75, and 76-100% of stem and branches area with disease symptoms, respectively. Disease incidence was calculated as the percentage of plants with symptoms on stem and branches.

Results and Discussion

Environmental conditions were less favorable to white mold in 2001 than in the previous two years. There was no interaction between planting densities and fungicide treatments. Final stand was 2.5, 7.5, and 8.1% lower than the correspondent initial stand of 8, 12, and 16 plants per meter, respectively (Table 1). All variables were linearly related to planting densities. White mold incidence and severity increased with the number of plants per meter. Yield components and grain yield decreased as planting densities increased. Fungicide treatments did not affect white mold incidence, but disease severity was reduced by fluazinam ($P < 0.05$). Fungicide

treatment increased bean yield components and grain yield ($P < 0.01$). These results indicate that low planting densities may reduce white mold incidence and severity and increase common bean yield. White mold control was cost effective.

Table 1. White mold incidence and severity, yield components, and grain yield at four planting densities with or without fungicide (fluazinam) applications

Treatments	Final stand	Incidence[1]	Severity	Pods/ plant	Seeds/ pod	100-seed weight (g)	Grain yield (kg ha^{-1})
Plants per meter		(1)	(2)	(3)	(4)	(5)	(6)
4	4.0	53.0 (59.0)[2]	1.09	26.7	4.64	25.0	2,623
8	7.8	67.2 (79.4)	1.53	17.7	4.48	23.8	2,612
12	11.1	72.8 (84.2)	1.78	11.4	4.33	23.4	2,538
16	14.7	77.4 (88.7)	2.02	10.3	4.20	22.3	2,396
Fungicide treatments							
with	9.5	65.0ns (76.2)	1.38*	17.9**	4.50**	24.3**	2,873**
without	9.4	70.2 (79.5)	1.83	15.1	4.33	23.0	2,211

[1] Arc sine transformation. [2] Untransformed mean percentage of incidence.
** = significant at 1% level, * = significant at 5% level, ns = not significant.
(1) $y = 47.96 + 1.194x$ $r^2 = 0.92$
(2) $y = 0.850 + 0.076x$ $r^2 = 0.98$
(3) $y = 30.42 - 1.388x$ $r^2 = 0.91$
(4) $y = 4.784 - 0.037x$ $r^2 = 1.00$
(5) $y = 25.79 - 0.213x$ $r^2 = 0.97$
(6) $y = 2.731{,}1 - 18.9x$ $r^2 = 0.87$