

Growth room study

Seed treatments differed significantly in their effects on plant height and dry mass (Table 14), but not survival rate. Seedlings from seed treated with Comx 1 and Comx 2 had significantly higher plant heights than the control and other treatments, whereas seedlings from seed treated with Comx 1 had significantly higher dry masses than seedlings from seed treated with Celest, Dynasty, Risolex and the control. Figures 14a-14d also illustrate the effect of the different seed treatments on plant growth.

Table 14. Effect of seed treatment with fungicides on seedling growth under growth room conditions.

Treatment ^y	Height (mm) ^z	Dry mass (g) ^z
Apron	274.97 bc	76.86 ab
Celest	275.36 bc	71.61 cde
Comx1 ^z	287.70 a	78.93 a
Comx2 ^z	281.56 ab	76.41 abc
Control	274.05 bc	72.35 b-e
Dynasty	276.84 bc	71.14 de
Risolex	270.19 c	69.90 e
Thiulin	274.92 bc	76.14 a-d
LSD (0.05)	8.14	28.62

^yComx 1 = mixture of Apron, Risolex and Thiulin at normal dosage; Comx 2 = mixture of Apron, Risolex and Thiulin at double the dosage.

^zMeans within a column followed by the same letter do not differ significantly (P = 0.05)

The fact that the combination of fungicides (Comx 1) significantly improved plant height is an indication that a complex of fungi is involved in root rot. The single components of this combination, viz. Apron (metalaxyl), Thiulin (thiram) and Rizolex (tolclofos methyl) did not have the same effect when applied separately. From the results of the field study (previous section), thus far it appears that, according to the literature, *F. graminearum* and *Pyrenochaeta terrestris* are the most important soilborne fungal pathogens associated with maize in Winterton. The *Pythium* spp. and *R. solani* AG-2-2 isolated from plants have been recorded as pathogens, but the incidences of these pathogens are quite low in the beginning of the season. Although fungicides such as metalaxyl should target *Pythium* spp., tolclofos methyl the *Rhizoctonia* spp. and thiram the *Fusarium* spp. (Nel *et al.*, 2003), it seems that each of these fungal groups do not account on their own for the stunting of plants from untreated seed. We could, unfortunately, not obtain any information on the effect of seed treatments against *P. terrestris* on maize. The fungicides included in this study, and many others have been evaluated by researchers in other countries and applied separately and in many different combinations, but not in the combination that we tested in this study (Baird, *et al.*, 1994; Wang & Davis, 1997; Manoj-Kumar & Agarwal, 1998; Munkvold & O'Mara, 2002; Dorrance *et al.*, 2004). Munkvold & O'Mara (2002) reported that difenoconazole and fludioxonil were generally more effective than captan as seed treatment to protect maize seedlings against *Fusarium* spp. Captan and fludioxonil are broad-spectrum fungicides with activity against *Fusarium* species, but although Celest and Dynasty contains fludioxonil these fungicides were not significantly more effective than untreated seed in this study. Captan, thiram and fludioxonil/mefenoxam are currently registered for treatment of maize seed in South Africa, but captan was not included in our preliminary study (Nel *et al.*, 2003). According to Munkvold & O'Mara (2002) most published reports on seed treatments of maize consist of results of field tests. Although these tests provide important information about the field performance of these fungicides, they do not provide information on the efficacy of these fungicides against specific pathogens. It is therefore crucial that fungicides should be evaluated against each of the pathogens of the disease complex separately in order to determine the best combination of fungicides for a specific situation.

Fig 14. Seedlings from seed treated with different fungicides and planted in canola (CAN) soil.



(a) From left, Comx 1, Apron, Risolex and Thiulin



(b) From left, Control, Apron, Risolex and Thiulin.



c) From left, Control, Comx 1 and Comx 2



(d) From left, Control, Celest, Dynasty and Comx 1