THE USE OF ANTAGONISTIC SPECIES OF *TRICHODERMA* AND CALCIUM NITRATE FOR THE SUPPRESSION OF BASAL STEM ROT OF OIL PALM SEEDLINGS

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Introduction

Basal Stem Rot (BSR) of oil palm, caused by species of *Ganoderma*, has been regconised as a serious disease of oil palm, causing severe economic losses. Control methods have been directed towards disease avoidance through reducing the amounts of potential infection source for the replanting at the time of clearing the old stand. Chemical control has not been effective and long lasting. Enumeration of the microbial population from the palm rhizospheres and sporophores showed the great diversity of fungi nonpathogenic to oil palm, which points to the pssibility of biological management of *Ganoderma*. Laboratory screening of these nonpathogenic fungi based on dual culture, competition, antibiosis and mycoparasitism showed that isolates of *Trichoderma* were highly antagonistic to *Ganoderma*, followed by isolates of *Penicillium* and *Aspergillus* (Sariah et al. 1998). Mechanism of antagonism was through competition and mycoparasitism which implies that early establishment of the antagonists in the rhizosphere of palms may be cruzial to produce the effect as expected.

Materials and Methods

Antagonistic species of *Trichoderma (T. harzianum, T. hamatum, T. longibrachiatum, T. koningii, and T. viride)* raised on padi grains were amended to the soil mixture in polibags at the time of inoculation and one month after inoculation. 60g of air-dried antagonist preparation (10^{10} cfu/g) were used for each seedling. The percentage of disease severity was calculated based on foliar symptoms on a scale of 0-3 (0=healthy; 1= chlorotic ; 2= dessicated), number of lesioned root and bole tissues. Number of fruiting bodies produced was also recorded.

The effect of soil amendment on disease severity and microbial activity in the palm rhizosphere was carried out by supplementing oil palm seedling with calcium nitrate at monthly intervals for a period of 6 months. Treatments include two rates of calcium (7.5g and 5g per seedling) and two intervals after inoculation. The development of disease symptoms were assessed as above. In addition, tissues of the roots of calcium supplemented seedlings were processed for histological observations and stained for the presence of calcium deposition in the cell walls. In all experiments, inoculation was carried out using rubber wood block as inoculum source (Teh, 1996; Sariah et al. 1994).

Results and Discussion

Soil augmentation with antagonistic species of *Trichoderma* significantly reduced the incidence of BSR on seedlings as based on the foliar symptoms and root infection. *T. harzianum* was highly antagonistic as compared to the other species of *Trichoderma*. Delayed application (one month after inoculation) increased symptom development in all treatments. However, the recovery of the *Trichoderma* species from the plant rhizospheres was low after four months of augmentation. This could be due to rhizosphere competency of the isolates, soil conditions and availability of nutrients which could influence the proliferation of the antagonists in the soil. This result suggests the possible use of soil amendments to sustain the survival and proliferation of the augmented antagonists.

Incidence of BSR was suppressed significantly ($p<0.05$) when seedlings were grown in soils supplemented with calcium nitrate one month prior to inoculation with *Ganoderma*-infected rubber wood blocks. Development of BSR symptoms was reduced by 25-30% based on foliar symptoms, number of sporophores produced, and number of lesioned roots. Seedlings deficient in calcium produced foliar symptoms observed as severe chlorosis and necrosis of leaves, lesioned roots and bole tissues. In addition, tissues of the roots of calcium deficient seedlings have thinner walls which may facilitate fungal penetration. Cell walls of calcim supplemented seedlings have well developed cell wall due to deposition of calcium pectate and resist degradation by cell wall degrading enzymes. Presence of calcium in the root tissues was detected by staining the sections with Alizarin red S. Population of antagonistic fungi (CFU) were significantly higher in calcium supplemented soil as compared to calcium deficient soil.

Conclusions

Soil augmentation with antagonistic species of *Trichoderma* and soil amendments with calcium nitrate reduced BSR development and severity based on foliar symptoms, lesioned roots and bole tissues on oil palm seedlings. However, the effectiveness of these antagonists in the field under natural disease pressure has yet to be evaluated.

References

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