

The biofertiliser, 'microbial inoculants', comprised of microbial inoculants or assemblages of living microorganisms which exert direct or indirect benefits on plant growth and crop yield through different mechanisms (Fuentes-Ramirez and Caballero-Mellado, 2005). It can be generally defined as preparations containing live or latent cells of efficient strain of nitrogen-fixing, phosphate solubilising (either bacteria, fungi or algae) or any other beneficial activity derived from this process. Endophytic fungus, *Hendersonia GanoEF1*, has been identified

as a potential biocontrol agent against *Ganoderma* disease based on *in vitro* and nursery trials (Idris *et al.*, 2010; Nurrashyeda *et al.*, 2011). A study was conducted to incorporate *Hendersonia GanoEF1* into organic and inorganic fertiliser as a carrier.

CHARACTERISTICS OF BIOFERTILISER *Hendersonia GanoEF*

The biofertiliser *Hendersonia GanoEF* contains endophytic *Hendersonia GanoEF1*, inorganic and organic fertilisers (Figure 1).



Figure 1. Biofertiliser *Hendersonia GanoEF*; pure culture of *Hendersonia GanoEF1* (A) and biofertiliser *Hendersonia GanoEF* powder (B).

*All Cosmos Industries Sdn Bhd, Pasir Gudang, Johor.

QUALITY OF BIOFERTILISER *Hendersonia GanoEF*

Quality of biofertiliser *Hendersonia GanoEF* was determined using a viability test expressed as *Hendersonia* colony forming unit per gramme (CFU g⁻¹) at monthly intervals up to 12 months at room temperature (27±2°C). After one to six months storage, the number of viable *Hendersonia* cells in biofertiliser carrier remained at 10⁸ CFU g⁻¹. Viability of *Hendersonia* cells declined to 10⁶ CFU g⁻¹ and 10⁴ CFU g⁻¹ after seven months and 12 months storage, respectively.

BENEFITS OF BIOFERTILISER *Hendersonia GanoEF*

- Effectively controlling *Ganoderma* disease.
- Environmental-friendly.
- Easy to apply in the nursery and field.
- Easy storage.

NURSERY EVALUATION OF BIOFERTILISER *Hendersonia GanoEF* AGAINST *Ganoderma boninense*

Effectiveness of the biofertiliser *Hendersonia GanoEF* in controlling *Ganoderma* disease is

based on quantitative assessments measured as disease incidence (DI), severity of foliar symptoms (SFS), dead seedlings (DS) (Figure 2) and disease reduction (DR) conducted over 10 months. At six months after treatment, percentage of DI was significantly lower in seedlings treated with biofertiliser *Hendersonia GanoEF* (46.7%) compared with the untreated seedlings at 93.3% of DI (Table 1). Similar trend was observed for SFS where seedlings treated with biofertiliser *Hendersonia GanoEF* recorded significantly lower severity of 48.4% compared to the untreated seedlings with SFS of 83.8%. DS in the control showed higher percentage (86.7%) and significantly different compared to the seedlings treated with biofertiliser *Hendersonia GanoEF* at 26.7%.

Basal stem rot (BSR) disease was reduced by 69.5% in seedlings treated with the biofertiliser *Hendersonia GanoEF* based on area under disease progress curve (AUDPC) (Table 2). Colonisation of *Hendersonia GanoEF*1 in oil palm roots was observed (Figure 3). Seedlings treated with *Hendersonia GanoEF*1 increased the levels of enzyme activities such as chitinase, lignin, peroxidase (PO) and phenylalanine ammonia lyase (PAL), which are known to be physical barriers to *Ganoderma* infection.



Figure 2. Seedlings treated with biofertiliser *Hendersonia GanoEF* and inoculated with *Ganoderma boninense* (A) and seedlings untreated with biofertiliser *Hendersonia GanoEF* and inoculated with *G. boninense* (B).

TABLE 1. DISEASE INCIDENCE (DI), SEVERITY OF FOLIAR SYMPTOMS (SFS) AND DEAD SEEDLINGS (DS) DUE TO *Ganoderma boninense* INFECTION AT SIX MONTHS AFTER TREATMENT

| Treatments | Disease assessment (%) | | |
|--|------------------------|-----------------------------------|---------------------|
| | Disease incidence (DI) | Severity of foliar symptoms (SFS) | Dead seedlings (DS) |
| Seedlings untreated with biofertiliser <i>Hendersonia GanoEF</i> and inoculated with <i>G. boninense</i> | 93.3 a | 83.8 a | 86.7 a |
| Seedlings treated with biofertiliser <i>Hendersonia GanoEF</i> and inoculated with <i>G. boninense</i> | 46.7 b | 48.4 b | 26.7 b |

Note: means within a column with different letters are significantly different at $p < 0.05$ according to t-test.

TABLE 2. EFFECT OF BIOFERTILISER *Hendersonia GanoEF* ON BASAL STEM ROT (BSR) DISEASE DEVELOPMENT IN OIL PALM SEEDLINGS AT SIX MONTHS AFTER TREATMENT

| Treatments | AUDPC [#] | DR ^{##} (%) |
|--|--------------------|----------------------|
| Seedlings untreated with biofertiliser <i>Hendersonia GanoEF</i> and inoculated with <i>G. boninense</i> (control) | 273.3 | - |
| Seedlings treated with biofertiliser <i>Hendersonia GanoEF</i> and inoculated with <i>G. boninense</i> | 83.3 | 69.5 |

Note: [#]area under disease progress curve. ^{##}Disease reduction.

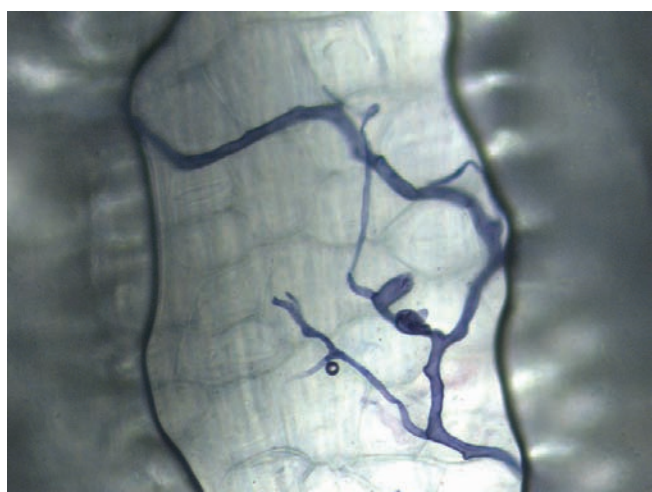


Figure 3. Colonisation of oil palm root with *Hendersonia GanoEF1* (20X magnification).

CONCLUSION

Biofertiliser *Hendersonia GanoEF* has the capability to inhibit the growth of *G. boninense* and control of the disease in oil palm.

REFERENCES

- FUNTES-RAMIREZ, L E and CABALLERO-MELLADO, J (2005). Bacterial biofertilizers. *PGPR: Biocontrol and Biofertilization* (A Siddiqui ed.). Springer, Netherland. p. 143-172.
- IDRIS, A S; NOOR HAIDA, S and NUR RASHYEDA, R (2010). *GanoEF1-A* fungal biocontrol agent for *Ganoderma* in oil palm. *MPOB Information Series No. 501*. 4 pp.
- NURRASHYEDA, R; IDRIS, A S; MADIHAH, A Z; RAMLE, M and KUSHAIRI, A (2011). *Hendersonia GanoEF1* granules for the control of *Ganoderma boninense* in oil palm. *MPOB Information Series No. 556*. 4 pp.

For more information, kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-8769 4400
Fax: 03-8925 9446
www.mpob.gov.my