

# CHEMICAL FERTILISER GanoCare™ AS PREVENTIVE TREATMENT IN CONTROLLING *Ganoderma* DISEASE OF OIL PALM

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**B**asal stem rot (BSR) disease caused by the *Ganoderma* species is a serious problem to the oil palm industry (Idris, 2011; 2012). MPOB has introduced the Integrated *Ganoderma* Management (IGM) to find solution to the disease (Idris, 2011). Plant nutrients are primary components of disease control in many crops (McMahon, 2012). It was reported that calcium nitrate suppressed BSR symptoms on clonal materials (Sariah and Zakaria, 2000). Copper has played a significant role in organic and conventional systems for controlling some fungal diseases. *G. applanatum* and *G. lucidum* causing wilt diseases in coconut trees could be reduced by application of copper-based fungicides (Nambiar *et al.*, 1992). Salicylic acid (SA), which is a naturally occurring plant hormone could induce resistance to the pathogen and abiotic stress tolerance in plants (Rahamah *et al.*, 2014). The importance of applications of balanced nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulphur (S), iron (Fe), manganese (Mn), copper (Cu) and boron (B) are critical available nutrients for oil palm and so incorporating these elements in fertilisers to control the disease may prevent *Ganoderma* attack (Mohd Tayeb *et al.*, 2003). Due to the limitations of fungicide usage to control the disease, it seems appropriate to seek an urgent, alternative control strategy for BSR disease. The manipulation of nutrient uptake is an important alternative strategy, as all essential plant nutrients influence the health of plants and their susceptibility to disease. Beneficial elements have positive effects on growth development, yield and disease resistance, which have been observed in a wide variety of plant species. Beneficial elements in fertilisers are routinely applied to several crops to provide high and sustainable crop yields. The effects of beneficial elements are mainly associated



Figure 1. Process of mass production of GanoCare™ OCSpecial: (a) materials input, (b) mixing of raw materials, (c) moulding, and (d) screening. Two forms of product: (e) pellet and (f) compact.

with its high level of deposition in plant tissues, therefore enhancing their strength and rigidity (Hanafi *et al.*, 2014). Beneficial elements are also potential in enhancing host resistance to plant diseases by stimulating defense reaction mechanisms. The GanoCare™ organic has been developed earlier using organic material and beneficial nutrients in reducing risk of *Ganoderma* in oil palm (Idris *et al.*, 2014). With joint research and development (R&D), MPOB, Universiti Putra Malaysia (UPM) and FELCRA Plantation Services Sdn Bhd (FPSSB), had successfully produced new formulation of GanoCare™. This new formulation incorporates chemical fertiliser into GanoCare™ and named as GanoCare™ OCSpecial for

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Figure 2. Four formulations of GanoCare™ OCSpecial: a) OCSpecial 1 (for nursery seedlings), OCSpecial 2, OCSpecial 3 and OCSpecial 4 (for immature and mature palms).

controlling *Ganoderma* disease and increase vegetative growth in oil palm.

### THE TECHNOLOGY – GanoCare™ OCSpecial

The GanoCare™ OCSpecial was formulated using balanced nutrients, which include macronutrients, micronutrients and beneficial elements, mainly for the prevention of *Ganoderma* disease, growth of oil palm and improve soil fertility. GanoCare™ OCSpecial contains N, P, K and Mg; powdered empty fruit bunches (EFB) and beneficial elements such as iron, manganese, copper and silicon. Four formulations of GanoCare™ OCSpecial were developed, they are OCSpecial 1 (for seedlings in nursery), OCSpecial 2, OCSpecial 3 and OCSpecial 4 (for field palms). Mass production process of GanoCare™ OCSpecial was established (Figures 1 and 2) and patented (PI 2012701060).

### EFFECTS OF GanoCare™ OCSpecial ON VEGETATIVE GROWTH OF OIL PALM SEEDLINGS

Evaluation on the effects of GanoCare™ OCSpecial (OCSpecial 1) on vegetative growth of oil palm seedlings was carried out in Seberang Perak, Batu Gajah, Perak. Two treatments were evaluated with 30 seedlings per treatment. The treatments were: T1 - control (NPK Blue, 12:12:17:2) and T2 - GanoCare™ OCSpecial (OCSpecial 1, 6:6:8:2). The treatments were applied at monthly intervals. At nine months after treatment, seedlings treated with GanoCare™ OCSpecial (T2) showed significant increase in total number of fronds, height, girth, rachis length, total dry weights (leaf, stem and roots) and leaf area compared to

the control (Table 1). Scanning electron microscopy (SEM) showed that root cell wall of seedlings treated with GanoCare™ OCSpecial were thicker than those of the control (Idris *et al.*, 2014).

### NURSERY EVALUATION OF GanoCare™ OCSpecial IN CONTROLLING BASAL STEM ROT DISEASE

In another experiment, the effectiveness of GanoCare™ OCSpecial (OCSpecial 1) in controlling BSR disease in oil palm seedlings was evaluated. Two treatments with 18 seedlings per treatment were employed: T1 - control (NPK Blue, 12:12:17:2); and T2 - GanoCare™ OCSpecial (OCSpecial 1, 6:6:8:2). The treatments were applied at monthly intervals. The seedlings were inoculated with *G. boninense* using the rubber wood block (RWB) sitting technique (Idris *et al.*, 2006). Disease assessments were based on disease incidence (DI), dead seedlings (DS) and disease reduction (DR). After eight months of inoculation, the DI of seedlings treated with GanoCare™ OCSpecial (40.0%) was significantly ( $p < 0.05$ ) lower compared to those of the control (93.0%). Seedlings treated with GanoCare™ OCSpecial recorded significantly ( $p < 0.05$ ) lower DS (36.0%) compared to the control (90.0%). Disease reduction (DR) was 77.8% in seedlings treated with GanoCare™ OCSpecial (Table 2).

### FIELD EVALUATION OF GanoCare™ OCSpecial IN CONTROLLING BASAL STEM ROT DISEASE

Field testing of the GanoCare™ OCSpecial (OCSpecial 1, 2 and 3) to control *Ganoderma* disease was investigated through the seedling

**TABLE 1. EFFECTS OF GanoCare™ OCSpecial ON VEGETATIVE GROWTH OF OIL PALM SEEDLINGS, NINE MONTHS AFTER TREATMENT**

Treatment	Total number of fronds	Seedling height (cm)	Girth (mm)	Rachis length (cm)	Chlorophyll (Chl SPAD)	Total dry weight (g)	Leaf area (m <sup>2</sup> )
T1	15 b	149.8 b	80.1 b	74.8 b	61.2 a	251 b	1.025 b
T2	16 a	194.5 a	89.6 a	86.9 a	61.1 a	305 a	1.280 a

Note: T1 - control (NPK Blue) and T2 - GanoCare™ OCSpecial (OCSpecial 1). Treatments applied at monthly intervals.

Means with the same letter within the same column are not significantly different at  $p < 0.05$  using Least Significant Difference (LSD).

baiting technique (Idris, 2012) in Seberang Perak, Batu Gajah, Perak. Two treatments were evaluated: T1 - control (NPK Blue and compound fertiliser of NPKMg as applied by FELCRA); and T2 - GanoCare™ OCSpecial (OCSpecial 1, 2 and 3). Forty-two seedlings per treatment were used. Twelve-month old seedlings were planted 35 cm away from *Ganoderma* infected palms (Figure 3). For treated seedlings, GanoCare™ OCSpecial 1 was applied in the nursery (nine applications

with 50 g per seedling at monthly interval, total 450 g per seedling), while in the field GanoCare™ OCSpecial 2 (four applications, at three-monthly intervals, total 4 kg palm<sup>-1</sup> yr<sup>-1</sup>) was applied. For the second and third years after planting, GanoCare™ OCSpecial 3 (four applications, at three-monthly intervals, total 8 kg palm<sup>-1</sup> yr<sup>-1</sup>) was used. After 21 months of planting, only 4.76% (2 out of 42) palms died due to *Ganoderma* infection were observed on palms treated with GanoCare™

**TABLE 2. EFFECTS OF GanoCare™ OCSpecial ON DEVELOPMENT OF BASAL STEM ROT (BSR) DISEASE IN OIL PALM SEEDLINGS, EIGHT MONTHS AFTER INOCULATION WITH *G. boninense***

Treatment	Disease incidence (DI, %)	Dead seedlings (DS, %)	Disease reduction (DR, %)
T1 - control (NPK Blue) and inoculated with <i>G. boninense</i>	93.0 a	90.0 a	77.8
T2 - GanoCare™ OCSpecial (OCSpecial 1) and inoculated with <i>G. boninense</i>	40.0 b	36.0 b	

Note: T1 - control (NPK Blue) and T2 - GanoCare™ OCSpecial (OCSpecial 1). Treatments applied at monthly intervals.

Means with the same letter within the same column are not significantly different at  $p < 0.05$  using LSD.

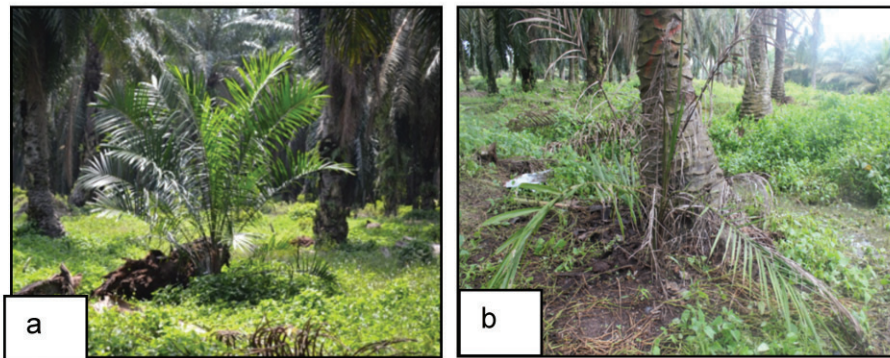


Figure 3. Field evaluation of GanoCare™ OCSpecial through seedling baiting technique, 21 months after planting. (a) Seedling treated with GanoCare™ OCSpecial (OCSpecial 1, 2 and 3) with no *Ganoderma* infection, and (b) control (NPK Blue and compound fertiliser) palm died due to *Ganoderma* infection.

OCSpecial compared with 83.3% (35 out of 42) of the control. *Ganoderma* infected palms were confirmed using the *Ganoderma* selective medium (GSM) as described by Ariffin and Idris (1992).

## CONCLUSION

The GanoCare™ OCSpecial can be used as a preventive treatment to control *Ganoderma* infection in oil palm, reducing potential yield losses in oil palm cultivation.

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