

## MINBOS TARGETS IMPROVED PROJECT ECONOMICS WITH FURTHER GREENHOUSE TRIALS TO OPTIMISE PRODUCT VALUE-IN-USE

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### HIGHLIGHTS

- » Minbos has agreed to collaborate on further Greenhouse Trials of the Cabinda Phosphate Rock Blend (Cabinda Blend) with the International Fertilizer Development Centre (IFDC).
- » These Greenhouse Trials, to be undertaken at the IFDC campus in Alabama, have been designed to:
  - demonstrate the enduring effect of the Cabinda Blend on second and third crops after a single initial application as observed in the last greenhouse trial;
  - confirm the maximum content of Phosphate Rock versus expensive MAP in the Cabinda Blend for productive use in simulated Angolan conditions; and
  - evaluate the advantage of granules versus compacted tablets and provide valuable data for further field trials in Angola in the coming season.
- » In addition, to ensure the Cabinda Blend is suited to Angolan crops and soils, the Company will engage the Angolan Institute of Agronomic Investigations (IIA) to complete an advanced Field Trial in Angola in the 20/21 field season
- » These trials have the potential to enhance the value-in-use of the Cabinda Blend product and improve project economics.

### BACKGROUND

**Minbos Resources Limited** (ASX:MNB) (“Minbos” or “the Company”) is pleased to announce that the International Fertilizer Development Centre (IFDC) has been engaged to undertake a new Greenhouse Trial in Alabama with a view to enhancing the value-in-use of the Cabinda Blend product.

Previous greenhouse trials completed by the IFDC confirmed that Cabinda Phosphate Rock blended with mono-ammonium phosphate (MAP) (Cabinda Blend) returned similar agronomic performance to MAP in crops and soils typical for Angola. The trials demonstrated positive agronomic outcomes, including:

- » A **Starter Effect** boost provided by the MAP content to promote early root development and plant growth;
- » An **Enhancement Effect** provided by the acidity of MAP and complemented by acid soils and plant rhizosphere to stimulate the dissolution of the Cabinda Phosphate Rock, and
- » An **Economic Benefit**, with Cabinda Blend significantly cheaper than commercial Water-Soluble Phosphate (WSP) Fertilizers, MAP and Diammonium Phosphate (DAP).

Significantly, previous Greenhouse Trials have demonstrated the potential for the Cabinda Blend to have a **greater economic benefit** than previously understood with 2<sup>nd</sup> and 3<sup>rd</sup> crops revealing a residual effect (benefits to subsequent crops from an initial application). The residual effect of phosphate from Phosphate Rock is recognized in academic literature and would boost the economic potential of the Cabinda Blend.

The new Greenhouse Trials, to be undertaken at the IFDC campus in Muscle Shoals Alabama, have been designed to evaluate the Cabinda Blend in local soils on soybean-wheat-sorghum crops grown in sequence to maturity to test several research comparisons including:

- » Determining the residual effect of Cabinda Phosphate Rock on grain yield and phosphate uptake with three crops grown sequentially to maturity in the same pots;
- » Estimating a minimum MAP concentration required to generate the Starter Effect, and
- » Evaluating the advantage of granulated versus tableted (compacted) product.

The current Field Trial in Huambo, designed by Plant Nutrition Science and Technology (NPCT) in Brazil and co-ordinated by the Angolan Institute of Agronomic Investigations (IIA), is ongoing, the crops have been harvested and the crop yields are being weighed. The objective of this trial was to prove the effectiveness of the Cabinda Blend in Angolan field conditions. Field Trials for the next growing season are being planned in collaboration with NPCT, IFDC and the IIA to compare the Cabinda Blend to commercially available fertilizers.

The IFDC is one of the world's leading fertilizer research and development organisations and a key technology partner for Minbos, facilitating the development of an innovative fertilizer product that is tailored to meet the growing agricultural demand of middle Africa.

Fertilizer consumption on the African continent is set to grow 79% by 2030, reaching 13.6 million tonnes by 2030 compared to 7.6 million tonnes currently. Importantly, international fertilizer companies have recognized the incredible growth and population trajectory of Africa, with multi-billion-dollar fertilizer investments:

- » 2017 - Indorama invests US\$1.5 billion in a fertilizer plant in Nigeria.
- » 2016 - OCP invests US\$3.7 billion in a fertilizer plant in Ethiopia.
- » 2016 - Toyota Tsusho commissioned a new large-scale (150,000 tonnes per year) fertilizer blending plant in Kenya to service Kenya and Tanzania.

### **Chief Executive Officer Lindsay Reed, commenting on the Greenhouse and Field Trials:**

*“Previous Greenhouse and Field Trials have proved to be an important and independent measuring stick for the agronomic potential of Cabinda Phosphate Rock. To have the IFDC, NPCT and IIA all involved in the design and implementation of the trials delivers world-class fertilizer Research and*

*Development expertise to our fertilizer development and an important third-party validation of its potential.*

*Logistics costs and limited domestic production means low fertilizer use in Middle Africa and crop yields significantly below that of other regions. Being able to produce a locally mined, manufactured, and distributed fertilizer tailored for local soils will have a significant economic benefit to a region where agriculture is the primary source of income. Ninety percent of the 9.6 million Angolans living in rural areas and 44% of Angola's 30.8 million population are employed in agriculture.*

*Our product takes natural Phosphate Rock and displaces expensive and less environmentally friendly WSP with a locally produced product, tailored to a large and growing market hungry for fertilizer.”*

### **FIELD TRIAL DETAILED**

The Minbos vision is to build a nutrient supply and distribution business that stimulates agricultural production and promotes food security in Angola and the broader Congo Basin. The Company's plan is to mine Phosphate Rock from the Cácata Deposit and transport it to the Porto de Caio where all the necessary electricity, gas, water and shipping infrastructure exists to build and operate a granulation plant to produce Enhanced Phosphate Rock granules (Phosphate Rock + MAP).

The Enhanced Phosphate Rock granules will become the P nutrient feedstock to blend with imported Nitrogen (N) and Potassium (K) granules in NPK blending plants to exact specifications suited to Angolan crops and soils.

To ensure the Cabinda Blend is suited to Angolan crops and soils, the Company has engaged the IFDC to complete an advanced Greenhouse Trial. As noted above, the past two Company trials were conducted at IFDC's greenhouse and evaluated direct application of Cabinda Phosphate Rock and compacted Cabinda Phosphate Rock with monoammonium phosphate (MAP) on wheat and a maize followed by a maize residual experiment.

MAP has a high P<sub>2</sub>O<sub>5</sub> content (52%) and the IFDC recommends its use for the following reasons:

- » It serves as a starter to help early plant growth with better root development that in turn results in more effective utilization of Phosphate Rock than with the use of Phosphate Rock alone at planting.
- » Non-granular MAP is cheaper than granular TSP/DAP.
- » MAP is an acidic fertilizer (pH 4.8) that may help PR dissolution.
- » Nitrification of NH<sub>4</sub><sup>+</sup> of MAP to NO<sub>3</sub><sup>-</sup> and H<sup>+</sup> ions in soils further enhances Phosphate Rock dissolution.

The trials will evaluate a wider range of MAP/Cabinda Phosphate Rock blends, compare tableted (compacted) product versus granulated, and determine residual effect of Cabinda Phosphate Rock on grain yield and P uptake with crops grown to maturity.

The main objectives of the new trials are to evaluate the agronomic effectiveness of Cabinda Phosphate Rock as mined and various MAP/Cabinda Phosphate Rock products for soybean-wheat-sorghum cropping with respect to:

- » Four P sources (Cabinda PR, 25 MAP:75 Cabinda PR, 37.5 MAP:62.5 Cabinda PR, and MAP) at five rates (0, 25, 50, 100, 200 mg/kg).
- » The effect of product preparation (granular vs tablets) at four P rates (25, 50, 100, 200 mg/kg).
- » The effect of seven MAP:Cabinda PR ratio (Cabinda PR, 12.5 MAP:87.5 Cabinda, PR 25 MAP:75 Cabinda PR, 37.5 MAP:62.5 Cabinda PR, 50 MAP:50 Cabinda PR, 75 MAP:25 Cabinda PR, and MAP) at 50 mg P/kg rate).
- » Effect of fresh and residual MAP and Cabinda PR application.
- » The trial will also seek to determine the minimum WSP content required in the blend to provide the starter effect for plants. This will enable the Cabinda Blend ratio of Phosphate Rock to MAP to be designed to maximise the content of US\$20 per tonne of phosphate rock vs US\$350 per tonne of MAP.

A full table of Field Trial treatments can be found in Table 1.

**Table 1. Treatment Table for Minbos Soybean-Wheat-Sorghum Field Trial**

Treat #	Appl P Fert	P Source	P Rate	Preparation	Reps
	Crop		mg/Kg		
1	Soybean	Control	0	DNA	3
2	Soybean	Cabinda PR	25	Granulated	3
3	Soybean	25 MAP : 75 Cabinda PR	25	Granulated	3
4	Soybean	37.5 MAP : 62.5 Cabinda PR	25	Granulated	3
5	Soybean	MAP	25	Granulated	3
6	Soybean	Cabinda PR	50	Granulated	3
7	Soybean	25 MAP : 75 Cabinda PR	50	Granulated	3
8	Soybean	37.5 MAP : 62.5 Cabinda PR	50	Granulated	3

9	Soybean	MAP	50	Granulated	3
10	Soybean	Cabinda PR	100	Granulated	3
11	Soybean	25 MAP : 75 Cabinda PR	100	Granulated	3
12	Soybean	37.5 MAP : 62.5 Cabinda PR	100	Granulated	3
13	Soybean	MAP	100	Granulated	3
14	Soybean	Cabinda PR	200	Granulated	3
15	Soybean	25 MAP : 75 Cabinda PR	200	Granulated	9
16	Soybean	37.5 MAP : 62.5 Cabinda PR	200	Granulated	9
17	Soybean	MAP	200	Granulated	3
18	Soybean	25 MAP : 75 Cabinda PR	25	Tablets	3
19	Soybean	25 MAP : 75 Cabinda PR	50	Tablets	3
20	Soybean	25 MAP : 75 Cabinda PR	100	Tablets	3
21	Soybean	25 MAP : 75 Cabinda PR	200	Tablets	9
22	Soybean	12.5 MAP : 87.5 Cabinda PR	50	Granulated	3
23	Soybean	50 MAP : 50 Cabinda PR	50	Granulated	3
24	Soybean	75 MAP : 25 Cabinda PR	50	Granulated	3
25	Wheat	MAP	25	Granulated	3
26	Wheat	MAP	50	Granulated	3
27	Wheat	MAP	100	Granulated	3
28	Wheat	MAP	200	Granulated	3
29	Wheat	PR	200	Granulated	3
30	Wheat	Check	0	Granulated	3
31	Sorghum	MAP	25	Granulated	3
32	Sorghum	MAP	50	Granulated	3
33	Sorghum	MAP	100	Granulated	3

34	Sorghum	MAP	200	Granulated	3
35	Sorghum	PR	200	Granulated	3
36	Sorghum	Check	0	Granulated	3

This announcement is authorised by the Board of Minbos Resources Limited.

**For further information, please contact**

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**ABOUT MINBOS**

Minbos Resources Limited (ASX: MNB) is an ASX-listed exploration and development company with interests in phosphate ore within the Cabinda Province of Angola and Rare Earth Elements in Madagascar. The Company’s immediate focus is to develop a project to produce a low-cost/high-yield fertilizer blend suitable for crops and soils within Angola and the wider Congo Basin.

For more information: [www.minbos.com](http://www.minbos.com)

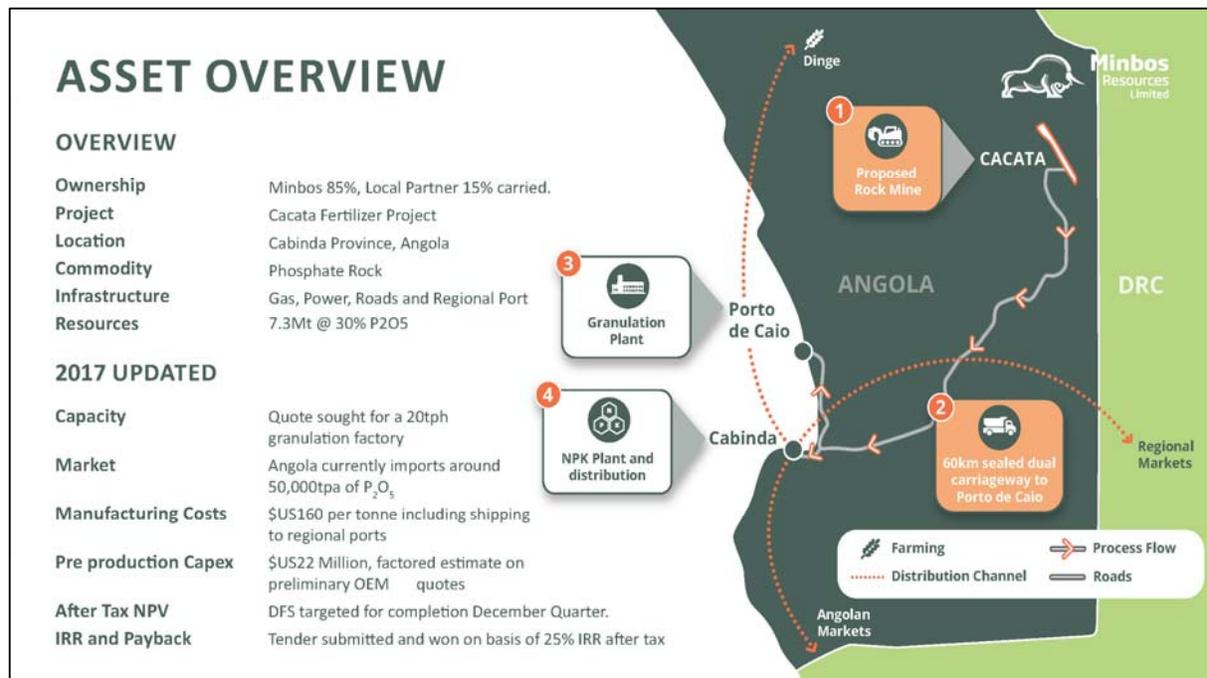


Figure 3 - Location of Cabinda Project highlighting the experience and institutional knowledge the Company has acquired over the years