2022 Green Blueprint (GB) Annual Report

10th January 2023

Summary of 2022 activities and outcomes

- Bill Crabtree returned from 22 months in Africa, to enable him to focus on GB matters.
- The relationship with Bioceres, Argentina (owners of the HB4 drought tolerance gene) is progressing well.
- Bioceres has expanded registration of HB4 wheat globally, including approval by FSANZ of HB4 wheat flour for use in food in Australia.
- GB has HB4 wheat plants in Australian germplasm being bulked for seed in quarantine, these lines are growing well.
- R&D on GB wheat with improved frost tolerance is advancing well with support from a COGGO grant.
- The GB wheat plants have been developed with increased expression of an anti-freeze protein (over 15 times that of the parent germplasm at flowering).
- GB has developed 17 new fixed wheat lines from crosses between Australian elite lines.
- GB welcomes more investors.
- This season's record harvest and good prices, and GB's R&D progress, makes this an ideal time to invest.
- GB intends to hold investor meetings this summer – please let us know of local interest.

1) Drought tolerant HB4® wheat

a) Drought-tolerant HB4® wheat in Australian-adapted germplasm

To develop drought-tolerant wheat, over several years, GB has held monthly online meetings with Bioceres, culminating in a visit by Martin Mariani Ventura, Global Seeds & Traits Manager of Bioceres. The HB4®gene (HaHB4) is a natural stress-tolerance gene from sunflower. Under quarantine, GB has imported lines of wheat seeds derived from an Argentinian variety containing the HB4®gene backcrossed into elite Australian germplasm (GB110). After meeting the regulatory import conditions, seeds of seven advanced lines carrying the HB4®drought trait are being multiplied in a containment glasshouse for field growth in the next generation.

Field trials in Argentina show that HB4® wheat yields on average 20% (up to +49% in some regions) more under severe to moderate drought conditions, but when water is not limiting, HB4® wheat yields are essentially the same as non-HB4® wheat. In Argentina, Bioceres is targeting regions where wheat yield potential is 1-4t/ha, where the HB4® gene has contributed to yield increases. The HB4® trait is combined with glufosinate ammonium (Basta) for herbicide tolerance, which FSANZ has also passed for other GM crops. Argentinian regulators approved widespread growth of HB4® wheat in October 2020. In 2021, Bioceres grew 55,000 hectares of HB4® wheat in Argentina under its identity-preserved HB4® program, with smaller areas in Uruguay and Paraguay. Brazil is the main market for Argentinean wheat and Bioceres has received import approval of HB4®wheat flour for animal and human use from Brazil's Ministry of Science Technology & Innovation.

GB is currently discussing a mutually agreed form of investment into GB by Bioceres, to progress commercial release of HB4®wheat in Australia. The latter involves the regulatory steps required for de-regulation (including OGTR submission, seed bulk up, field testing and ground-truthing the trait, distribution and marketing).

b) Approval for the use of HB4®wheat for food and feed in Australia

Last year, following a call for comments, Food Standards Australia New Zealand (FSANZ) granted the approval for foods derived from HB4® wheat flour to be imported and used in Australian food products. In terms of growing HB4® wheat in Australia, the Office of the Gene Technology Regulator (OGTR) is in charge of approving crops grown by farmers. GB, in collaboration with Bioceres are now seeking permissions with

OGTR to test HB4® wheat in Australia as regulated field trials. In addition, Bioceres is seeking approvals for commercial growth of HB4®wheat and HB4®soybean in a range of other countries internationally. Notably, this includes Indonesia and other countries in South-East Asia.

2. Development of frost-tolerant wheat

GB has identified endogenous anti-frost proteins (AFPs) that can confer tolerance to frost in wheat and is working to increase the expression of the AFPs and their genes at developmental stages susceptible to frost damage. The aim is to use gene-editing (GEd) technology such that the wheat plants developed will not be classified as GMOs. The germplasm under study is of Australian-adapted high-yielding wheat.
This work is proceeding in three phases: (i) generation of transgenic plants with edited control sequences to increase expression of target AFP or the genes or both (ii) characterisation of the plants generated, and (iii) selfing selected edited wheat lines to identify 'null-segregants', that is, more frost-tolerant GE lines which do not contain introduced genetic material, and are therefore not classified as GMOs.

GB has made progress in all three of these phases. It has clear evidence that wheat AFP genes provide low temperature protection in model species and that AFP target sequences have been edited. The work this year has resulted in 13 edited lines with elevated AFP gene expression, which is very encouraging.

Gene promoter research (COGGO)

Phases (i) and (ii) have been partly funded by a grant from COGGO, and GB is planning to expand work on increasing the expression of the AFPs, and to challenge lead lines under controlled frost conditions.

3. Wheat germplasm development

GB is also generating and evaluating elite new breeding material more suitable to the north-eastern wheatbelt of WA. Wheat breeder Dr Peter Carlton has been developing wheat populations with long coleoptiles and rapid grain growth with elite Australian genetic backgrounds. These lines can be used by GB for additional GM or GEd trait development. From the most advanced material, GB now has 17 fixed lines from an elite cross, which will be tested for yield at sites in WA in 2023.

4. GB business structure options

In 2022, GB engaged Dr David Evans (Founder and Editor, GoldNerds; Modeller and Author) who has assisted with financial term sheets, income projections for HB4®and AFP wheats, and business development issues. He has proposed a sound business structure.

5. New investment into GB – last year and coming soon

GB secured new Level B investment and is pleased to welcome new investors in the 2022-23 financial year. It is encouraging to report that the business modelling done by David Evans predicts that GB has the potential to generate substantial income. With recent good harvests and prices, we believe this is an excellent time to invite further investment in GB. The business modelling indicates GB's value has increased substantially, and that this value will be reflected in the future share purchase price. GB proposes to hold a series of meetings for current and future shareholders on the projected valuation. GB is also in discussion with a local company which has expressed strong interest in investing.

6. Additional funding

Additional funding opportunities include the Australian Government's 'Accelerating Commercialisation' scheme: GB is also active in following up on other funding schemes as they are announced.

Sincerely submitted

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Dr Jon Clements, Director/Plant Breeder
Dr John Fosu-Nyarko, Director and Molecular Biologist
Prof Michael Jones, Senior Advisor to GB and Professor of Agricultural Biotechnology