POSITIVE RESULTS WITH FLAVOCIDE™ VS. GRAIN STORAGE PESTS

- **Flavocide™ demonstrates effective control of major grain storage pests in Department of Agriculture & Fisheries, Queensland Government (DAF) laboratory studies**
- **Combination treatments with Flavocide™ shown to control the full spectrum of key pests evaluated, including strains with history of multiple resistance to currently used insecticides**
- **Results indicate potential compatibility of Flavocide™ being used in combination with other compounds in resistance management strategies currently employed by the international grain protection industry where insects can cause up to 50% losses in untreated stored grain**

Bio-Gene Technology Limited (ASX: BGT, "Bio-Gene" or "the Company"), an agtech development company enabling the next generation of novel insecticides to address insecticide resistance, is pleased to announce initial positive results using Flavocide™ in combination with different grain protection compounds against a range of key grain storage pests. The findings are from research on development of new grain protectants, as part of a collaborative venture with DAF which commenced in December 2017.

Commenting on the results, Bio-Gene CEO Richard Jagger said, "The data generated from our collaboration with DAF is highly encouraging. The current strategy adopted by the industry is to use multiple combinations of compounds to effectively manage a range of pests and address resistance problems. There is a continuous program to evaluate novel insecticides which have future potential as effective grain protectants to provide broad spectrum control. These results show the promise of incorporating Flavocide™ into pest management programs to give the industry more opportunity to effectively manage the ongoing pests and resistance problems. This enables us to commence discussions with potential industry participants to seek collaborations for the commercial application of this technology in the area of grain protection in both Australian and international markets".

Test results confirmed that Flavocide™ was effective at controlling susceptible and resistant strains of lesser grain borer, saw-toothed grain beetle, the rusty grain beetle, rice weevil and flour beetle when used in combination with Chlorpyrifos-methyl (an organophosphate (OP) from Dow AgroSciences). Further combination testing with Deltamethrin (a synthetic pyrethroid (SP) from Bayer CropScience) and Flavocide™ demonstrated effectiveness in controlling an SP resistant strain of lesser grain borer.

Both Chlorpyrifos-methyl and Deltamethrin are currently used as grain protectant insecticides. Grain storage pests exhibit varying levels of resistance to these products, and the industry is looking for novel insecticidal compounds to be used in combination with existing chemistry to maintain efficacy and prevent development of further resistance. The results from these tests showed that combination treatments with Flavocide™ could effectively control the full spectrum of key pests including resistant strains. Importantly at present, no available insecticide controls all major grain storage pests.

Further tests will include evaluation of Flavocide™ alone and in combination to demonstrate the residual potential of Flavocide™ over an extended period which is an important requirement for industry acceptance.

Losses of grains and grain-based products caused by insects are a global problem, ranging from approximately 10% in temperate regions to almost 50% in humid tropical areas[1]. The protection of stored grain is an important economic necessity, particularly grain used for domestic human consumption and export which must not contain live insects.

In December 2017 Bio-Gene announced the results of initial successful studies against resistant strains of lesser grain borer (*Rhyzopertha dominica*). This extension of the collaboration with DAF targeted other key grain storage pests that again included lesser grain borer, but also the rice weevil (*Sitophilus oryzae*), the flour beetle (*Tribolium castaneum*)), the saw-toothed grain beetle (*Oryzaephilus surinamensis*) and the rusty grain beetle (*Cryptolestes ferrugineus*). Both susceptible and resistant strains of insects were included in the tests that comprised assessments of adult mortality at 14 days after treatment, and subsequent survival of progeny from the initial infestation.

These latest studies showed that the presence of Flavocide™ in combination with OP/SP-based products effectively controlled OP/SP-resistant strains of target pests as well as providing the means to control a broad range of grain storage pests. Table 1 below summarises results with Flavocide™ when used alone or in combination and lists the activity of different chemical treatments against the major pest types[2].

Table 1:

Chemical Class	Lesser grain borer	Rusty grain beetle	Sawtoothed beetle	Flour beetle	Rice weevil
Flavocide™ + OP	✓	✓	✓	✓	✓
Flavocide™ + SP	✓	n/a	n/a	n/a	n/a
Flavocide™	✓	✓	✓	-	-
Organophosphates	*	✓	*	✓	✓
Pyrethroids SP	✓	✓	✓	✓	*
S-methoprene IGR	*	-	✓	-	-
Spinosad	✓	-	-	-	-

✓ activity - no activity ***** *resistance widespread* ***n/a*** *test not yet conducted*

This demonstrates the compatibility of Flavocide™ with resistance management strategies currently being used in the grain protection industry, that utilise combination treatments comprising products of different modes of action to control resistant insect strains and also prevent the development of resistance to products still effective.

Dr. Manoj Nayak, Leader of the Postharvest Grain Protection Unit within DAF, is co-ordinating the collaborative project with Bio-Gene. "This result confirms that Flavocide™ can potentially be used as part of an integrated strategy to control some of the key pests of grain storage. Grain can be infested by a variety of insect pest species and no one grain protectant product is able to effectively control all species, thus requiring the use of combinations of different chemical types in order to effectively protect infested grain. Flavocide™ could therefore provide the ideal partner with a number of currently used products that in combination may offer a means to effectively control the full range of target pests, including resistant strains." Dr. Nayak said.

-ENDS-

[1] Wijayaratne,L.K.W., F.H.Arthur, S.Whyard (2018) Methoprene and control of stored-product insects. Journal of Stored Products Research Vol 76, March 2018, pp161-169

[2] Activity of chemical treatments information adapted from: http://storedgrain.com.au/wp-content/uploads/2015/03/GSFS-15_Applying-grain-protectants_NS_web.pdf

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About Bio-Gene Technology Ltd

Bio-Gene is an Australian AgTech development company enabling the next generation of novel insecticides to address the global problems of insecticide resistance and toxicity. Its novel platform technology is based on a naturally occurring class of chemicals known as beta-triketones.

Beta-triketone compounds have demonstrated insecticidal activity (e.g. kill or knock down insects) via a novel mode of action in testing performed to date. This platform may provide multiple potential new solutions for insecticide manufacturers in applications across animal health and crop protection, as well as in public health, and in consumer applications.

The Company's aim is to develop and commercialise a broad portfolio of targeted insect control and management solutions.

About Dr. Manoj K Nayak & DAF

Dr. Manoj Nayak is Leader of the Postharvest Grain Protection Unit, Crop and Food Science Agri-Sciences division within the Department of Agriculture and Fisheries, Queensland Government, where he leads an internationally recognised research program focused on the control of insects in grain storage. The testing and development of grain storage products, including new grain protectant insecticides, is a primary goal of Dr. Nayak's research group.

Dr. Nayak has had extensive experience in post-harvest grain biosecurity, with his main research interests comprising development of grain protectants and fumigants, resistance management and integrated pest management in stored grain and processed food. In addition to being involved in several Grains Research and Development Corporation (GRDC) projects, he was lead researcher in an Australian Centre for Agricultural Research (ACIAR) project and has successfully led eight Co-operative Research Centres (CRC's) for National Plant Biosecurity research projects. Dr. Nayak had published extensively and his expertise on resistance management in grain protection has led to numerous keynote presentations at international conferences.