Submission to Food Standards Australia New Zealand

Regarding application: A1085 – Food derived from Reduced Lignin Lucerne Line KK179

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Submitted with Grasslanz Technology board approval.

Role of alfalfa in agriculture and the human food chain

In most agricultural regions world-wide alfalfa is a component of an animal total mixed ration diet or is utilised as a hay or silage and is not generally grazed. A significant opportunity exists in many temperate regions that utilise a grazing pastoral system to grow grazing tolerant alfalfa varieties or to increase the use of alfalfa in cut and carry systems. A significant advantage of alfalfa over many other forage species is increased drought tolerance meaning that in dry seasons farmers can rely on alfalfa for animal feed long after grasses and clover species have stopped growing.

Alfalfa is also part of the human food chain with the main use being alfalfa sprouts that form part of salads.

Forage legumes typically have very low energy content but are valuable source of fibre and protein for ruminant animals. A general feature of many forages including alfalfa is a relative imbalance of energy sources with too much protein compared to water soluble carbohydrate, lipids and structural carbohydrate. The energy shortcomings of forages while a limitation, also present a significant opportunity for increasing feed value and productivity.

The current alfalfa market (primarily cut and carry) alone represents a significant market. Alfalfa is the fourth largest crop in the U.S. (9 million ha), typically makes up about 20% of dairy rationing with variability driven by price pressures from both less expensive hays (alternative roughage) and silages/oil seeds (supplemental energy). To increase the energy content of alfalfa and bring it to a more ideal balance of protein, carbohydrates and lipids would greatly reduce the crop's price elasticity and furthermore allow it to gain further market penetration in terms of feed rationing.

The New Zealand dairy pastoral grazing system represents roughly 8 million ha. Currently the main forage species grown are perennial ryegrass and white clover. A significant opportunity exists for farmers to utilise grazing tolerant alfalfa as these varieties become available to capture the increased drought tolerance. However with current non-GM varieties the same energy shortcomings exist.

Modifications in Lucerne KK179

The reduced lignin Lucerne (alfalfa) line KK179 described in application KK179 presents a major opportunity for the industry. This alfalfa line has been modified to contain a reduced level of lignin, the structural polymer that comprises the plant cell wall and along with the cellulose and hemi cellulose component is the source of dietary fibre for the animal. This plant has an improved forage quality and will help address the energy short comings of this forage species.

Diploid plant species exist with mutations in the *caffeoyl CoA-O methyltransferase* (*CCOMT*) gene (e.g. barley and rice) and this mutation has been referred to as the brown mid rib mutation. These plants have either naturally occurring mutations or have been generated by chemical or radiation mutagenesis. The diploid nature of these species means that the mutations are dominant and breeders are able to develop lines with the reduced lignin trait being expressed in all individual plants. Alfalfa has a complex tetraploid genome and is an out crossing species and therefore while it is possible to find naturally occurring mutations in individual CCOMT genes these mutations are recessive and are not expressed in high frequency in a variety. The GM approach to suppress the endogenous CCOMT gene in Lucerne KK179 leads to suppression of all four copies of the CCOMT gene and therefore a lower level of lignin. Therefore GM technology is an appropriate tool to obtain the genetic variation that leads to improved feed quality in this species.

Analysis has shown that line KK179 has altered levels of lignin, specifically in G lignin. The total overall lignin level while significantly different still fell within the range seen in a range of non-GM reference varieties grown at the same time. The main advantage to growers in using Lucerne line KK179 is that they have increased flexibility in harvest dates as this line maintains forage quality longer than conventional varieties.

Compositional analysis of Lucerne line KK179 indicated that only three additional analytes (ash, canavanine and ferulic adid) were significantly different. It would appear form the analysis that apart from the altered lignin trait Lucerne line KK179 is otherwise comparable to non-GM varieties of alfalfa. No potential public health and safety concerns have been identified.

Support for Application A1085

Grasslanz Technology supports application A1085 seeking approval for food derived from lucerne line KK179.

Long term we believe alfalfa line KK179 provides a significant opportunity to address the relative energy balance short comings of alfalfa. This line provides growers with greater flexibility in harvest times without compromising forage quality.

While alfalfa is still a growing market in New Zealand this species had significant potential to farmers due to its productivity and drought resistance especially compared to the current forage species white clover and perennial ryegrass. At present it is not intended to commercialise Lucerne line KK179 in New Zealand however if the value proposition is demonstrated in international markets it is important that New Zealand farmers are not shut out of the opportunities provided from this GM technology.

As an animal feed, this GM alfalfa is one step removed from the human food chain. The milk and meat products from animals fed this line are not expected to pose any human health risks. If introduced into New Zealand, stewardship programmes could effectively prevent this line from directly entering the human food chain. However, in the event this did occur it is unlikely that there would be any human health risk. Likewise in international markets it is unlikely that this line would enter the human food

chain. The potential for this line to enter the food chain in New Zealand through this route would be through imported alfalfa. However, in the event this did occur it is unlikely that there would be any human health risk.