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Summary Report for Carbon Wheat Crop Calculator Project

This project aimed to analyse Nitrous Oxide emissions from agricultural soils, specifically from On-farm actions for wheat plantations and see how sustainable practices under the ASP Certified Standard (elaborated by Southern Cross Agricultural Exports) can be beneficial in mitigating N_2O emissions as opposed to a Business as usual (BAU) scenario. For this, a literature review was undertaken of which 11 peer-reviewed papers where analysed for greenhouse gas (GHG) emissions with regards to these practices. The papers were from different locations in Australia (QLD, NSW, VIC, WA) and each of them analysed various factors affecting GHG emissions such as different amounts of Nitrogen fertilizers used, Tillage vs. No-Tillage, Type of soil, irrigation practices, nitrogen inhibitors, stubble burning, and retention as well as crop rotation among others.

Our results where obtain through an online survey, which was validated by Matt Barnes and Miriam Neilson (from Soil Planners and Southern Cross Agricultural Exports respectively) and distributed by Soil Planners through their network of farmers. The survey was elaborated using the Qualtrics software and sent to each participant as a link. Its design was done in such a way that it focused on N2O emissions from fertilizers but also included CO2 emission from diesel and hydrolysis of urea fertilizers given that these are directly dependant on fertilizer use. Furthermore, for each farmer, it contained information for three different paddocks representing their best, average, and worst yielding paddocks.

At the time of writing, 8 different farmers had been loaded in the system, and as a result, there are 24 different emission scenarios. There are four farmers from NSW, three from QLD, and one from WA. Five of the eight used some kind of nitrogen-based fertilizer, although in very small quantities (the highest of them being 3.4 Kg N / ha), and as a consequence their GHG emissions attributed to N_20 where almost negligible (with 2.66 $kgCo_2e$/Tn as the highest value). Two farmers did not use any fertilizers at all and the rest used either biological or a combination of biological and nitrogen-based fertilizers. As a consequence of the low nitrogen use, most of the emissions accounted were due to diesel use in machinery (which included planting, harvesting, pesticide application, and fertilizer application). From the data recollected the average GHG emissions were 17.42 $kgCo_2e$/Tn with a low of 4.68 $kgCo_2e$/Tn and a high of 76.77 $kgCo_2e$/Tn. From literature, the 11 studies yielded 29 different scenarios of which only 9 had a value of less than 76 $kgCo_2e$/Tn (our highest value). The literature average was 90.76 $kgCo_2e$/Tn, with a high of 262 $kgCo_2e$/Tn and a low of 11.5 $kgCo_2e$/Tn. In comparison, our results have an 80% decrease in average emissions although there is also a 28% decrease in average yield.

Given that most of the ASP farmers emissions were a consequence of machinery use, it is interesting to compare fuel use consumption with literature values. In literature, values ranged 23 to 37 $kgCo_2e$/Tn (Brock et al. 2016; Brock et al. 2012; Biswas et al. 2008; Wang & Dalal 2015). Our results show that only Farm #3 and the worst yielding paddock of farm #5 fall in that range. All other 20 scenarios are below that emission bracket. The average of all our farmers was 16.9 $kgCo_2e$/Tn, showing that a decrease in fertilizer use led to a decrease in diesel use from machinery.

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