January 5, 2022

Dr. Cheryl Laskowski
California Air Resources Board
1001 I Street
Sacramento, CA 95812

Dear Dr. Laskowski,

Nuseed is submitting for consideration by the California Air Resources Board (ARB) this proposal for future changes in the LCFS program to include non-food cover crops, including crops that are contract grown and harvested such as Nuseed Carinata, in the program and allow their GHG savings and soil carbon benefits be accounted in the modeling (CA GREET + Soil Carbon Model).

Farmers in the US and across the world are already on the front lines of climate change and have future challenges ahead of them. They have the potential to be part of the climate change solution, and that solution is in the soil. Governor Gavin Newsom through Executive Order N-82-20 stated that California needed to accelerate the natural removal of carbon and store more carbon in the soils and protect biodiversity. To be able to reach net negative carbon emissions California must incentivize the removal of millions of metric tons of carbon dioxide equivalents from the atmosphere. The most efficient way is through nature and covering bare soil on agricultural lands. To help further this discussion it is important to clearly define cover crops.

Cover crop definition – Non-food grasses, legumes and flowering plants (i.e. forbs) which impart conservation benefits such as erosion control, soil health improvement, weed and other pest control, habitat for beneficial organisms, improved water efficiency, nutrient cycling, and water quality improvement. Cover Crops are planted to cover, not allowing for any bare soil, during difficult growing conditions with typically low sunlight, harsh weather conditions and limited growing window. Cover crops are terminated prior to the main cash crop being planted through management such as chemical application, crimping, harvesting, rolling, tillage, grazing, or cutting. Cover Crops since they are grown outside the normal main growing season and are non-food crops do not have any land impacts as they do not replace/effect normal food agricultural production.

Cover crops are great for improving soil health and water quality. Healthy soil stores more water, which makes farms more resilient to the impacts of extreme weather brought on by climate change. Additionally, cover crops also mitigate the greenhouse gas emissions that contribute to climate change.

Plants convert CO_2 into organic matter through photosynthesis, so natural ecosystems are incredibly important to mitigate climate change. Similarly, cover crops and practices that follow soil health principles

have enormous potential to fight climate change - about 70% of cover crops' greenhouse gas mitigation potential comes from soil carbon storage. Estimates of the exact potential emissions reductions vary in scientific literature, this is due to the uncertainty about the permanence of sequestered carbon due to factors that can't be predicted or control, like urban development. Farms need to be continually managed for soil health over the years to reach the full potential of soil carbon sequestration; if farms are converted to urban development, the soil carbon benefits will be lost. Nevertheless, if all farms were managed to optimize soil health, then farmland has the potential to be a huge carbon sink.

Planting cover crops indirectly reduces nitrous oxide emissions by taking up the nitrogen through their roots, reducing the flow of water on the surface and increasing the infiltration of water and nutrients into the soil. This creates more opportunities for plants to trap nitrogen in the field instead of where microbes in streams and aquifers can turn it into nitrous oxide. The end result is that planting cover crops reduces nitrous oxide emissions downstream, in streams and aquifers. While reduced fertilizer use following cover crops is not guaranteed, it stands to reason that if cover crops are taking up more nitrogen and reducing loss of nitrogen from the field into water supplies, or even fixing their own nitrogen from the air, that farmers will need to apply less fertilizer on their crops after planting cover crops.

When more carbon is brought to the soil than is released, carbon accumulates in the soil, and vice versa. Increments in plant productivity and input of plant residues to soil can have an increasing effect on soil carbon stock. Changes in soil carbon stocks over time can be estimated through repeated measurements or dynamic models. A soil survey provides both an estimate of the stock of soil organic carbon when conducted for the first time and an estimate of the stock change when repeated. Dynamic soil carbon models provide an alternative for obtaining soil organic carbon estimates. Changes in soil carbon result from an imbalance between the carbon fluxes into and out of the soil. Typically, the soil carbon stock is large (example - 150 MT/ha) and thus small changes (increase 1.5 MT/ha) would be hard to determine based on low precision analytical techniques and testing accuracy. Because of the variation in soil properties, e.g. in the soil carbon stock, a large number of samples are required in order to provide soil carbon estimates that are accurate enough for monitoring purposes.

Three soil carbon measurements commonly used are clod, core, and excavation. For the clod method, a scientist takes a clod of soil from the surface or another specific depth and takes it to the lab for chemical analysis. The core method uses a hollow tube to pull a core of soil from a specific depth for analysis. The excavation method is the least common of the three, as it requires the most time and labor. However, it is considered the most accurate of the methods. It involves digging a large pit to get at a large amount of soil. The core method which is commonly referenced is the most inaccurate way to measure soil carbon. Soil carbon measurement presents several challenges: the need to monitor small incremental changes in soil carbon content relative to large carbon pools, long-time periods to accrue the full carbon benefits, high local variability of soil carbon content, and relatively costly soil carbon measurement procedures.

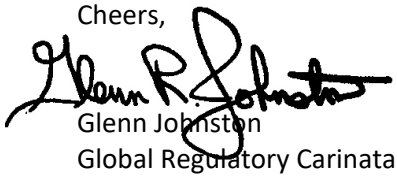
Conducting carbon soil modeling through soil models like the CENTURY model provide for an accurate forecast on plant-soil nutrient cycling to simulate carbon and nutrient dynamics. The CENTURY model is an ecosystem model used to simulate carbon and nutrient dynamics (N, S, P) for different types of ecosystems including grasslands, agricultural lands, forests, and savannas. All of these carbon models align with the scientific work done through IPCC.

It's not only up to farmers to make the change to regenerative, climate-friendly agriculture techniques. CARB through the LCFS should create policies that will drive change toward regenerative agricultural systems via support of Executive Order N-82-20. Allowing soil carbon benefits in the GHG models for non-food cover cropping via ecosystem models like CENTURY and DAYCENT (a soil carbon model with logic from CENTURY but with a daily time step) will drive net negative carbon emissions and create adoption of cover crops as a low-carbon fuel feedstock to reduce the carbon footprint of hard to decarbonize sectors, like aviation.

I hope this information provides insight into the numerous benefits of harvested non-food cover crops such as Nuseed Carinata, including soil carbon benefits. Carinata is decarbonization starting at the root as it is a non-food, non-GMO, cover crop that advances sustainable soil management practices.

I look forward to any questions you have and would be happy to discuss further.

Cheers,



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Nuseed