

# EPA Methodology Inaccurately Calculates N<sub>2</sub>O Emissions

## As it Relates to Soybean Production

The Environmental Protection Agency (EPA) Notice of Proposed Rulemaking (NOPR) on the RFS-2<sup>i</sup> miscalculates the N<sub>2</sub>O emissions for soybean production. Correcting the EPA error will add 21 percentage points to the EPA projected 22 % reduction in greenhouse gas (GHG) emissions for biodiesel produced from soybean oil.

The EPA included a “Draft Regulatory Impact Analysis: Changes to the Renewable Fuels Standard” (DRIA), which presents the technical analysis and data used to prepare the proposed rule.

### N<sub>2</sub>O Emission for Soybean Production:

Page 316 of the DRIA includes Table 2.6-13, “Domestic Agriculture GHG Emission Changes by Scenario, 2022”, which overstated the “fertilizer application / Soil N<sub>2</sub>O Emissions for soybean production. The table shows an increase in CO<sub>2</sub> emissions by 654,440 tonnes and 14,730 g/MMBtu, respectively.

The accurate calculation should show a decrease in CO<sub>2</sub> emissions by -244,560 tonnes and -5,504 g/MMBtu.

A difference (decrease) of 899,000 tons per year!

In terms of a percentage for reducing GHG emissions the decrease is 20.9 percentage points.

The domestic GHG emissions reported in Table 2.6-13 of DRIA are overstated because of FASOM’s incorrect treatment of nitrogen fixing crops. It appears that FASOM model used has not been updated with this latest guidance from Intergovernmental Panel on Climate Change (IPCC). Thus the DRIA grossly overstates the N<sub>2</sub>O emissions by a factor of three compared to that which would be calculated by the IPCC guidelines (which EPA states is methodology being followed).

As plants decompose they are going to release carbon into the atmosphere but the debate for soybeans centered on what happened to the Nitrogen that was created (fixed) by the plant. If you pull up a soybean plant you will notice small white nodules on the roots; those nodules are fixing (creating) nitrogen, thus why you do not need to apply Nitrogen to legumes such as soybeans, clovers, dry edible beans, etc.

The IPCC recently stated that you would not count N<sub>2</sub>O emissions from the nitrogen fixed by soybeans

Again, the domestic net N<sub>2</sub>O emissions reported for the biodiesel only case of 654,000 tons should actually be - 245,000 tons, a difference of 899,000 tons per year.

Historically, the application of nitrogen fertilizer and the growth of nitrogen fixing crops results in increased N<sub>2</sub>O emissions. However, soybean production only uses a small quantity of nitrogen so most of the N<sub>2</sub>O emissions result from nitrogen fixation and the decomposition of crop residues.

Figure 2.6-12 of DRIA indicates that a total of about 750 kg CO<sub>2</sub> eq/acre of N<sub>2</sub>O are released during soybean production. Five hundred kg CO<sub>2</sub> eq/acre are due to nitrogen fixing. There has been some debate in the scientific community in the last decade about the generation of N<sub>2</sub>O from nitrogen fixing crops. This was resolved several years ago when the Intergovernmental Panel on Climate Change (IPCC) released their 2006 Guidelines for National Greenhouse Gas Inventories.

In Volume 4, Section 11.2 it is stated that:

*Biological nitrogen fixation has been removed as a direct source of N<sub>2</sub>O because of the lack of evidence of significant emissions arising from the fixation process itself (Rochette and Janzen, 2005). These authors concluded that the N<sub>2</sub>O emissions induced by the growth of legume crops/forages may be estimated solely as a function of the above-ground and below-ground nitrogen inputs from crop/forage residue (the nitrogen residue from forages is only accounted for during pasture renewal). Conversely, the release of N by mineralisation of soil organic matter as a result of change of land use or management is now included as an additional source. These are significant adjustments to the methodology previously described in the 1996 IPCC Guidelines.*

FASOM's states that they calibrated the model to the 2001 EPA emission data, that data would have used the old IPCC guidelines and methodology rather than the most recent 2006 IPCC guidelines.

The FASOM data is contained on page A-52, of their analysis entitled:

*October 2008 - Agricultural Impacts of the Energy Independence and Security Act: FASOM Results and Model Description Final Report,  
Prepared for U.S. Environmental Protection Agency Office of Transportation and Air Quality  
Ariel Rios Building  
1200 Pennsylvania Avenue, N.W.  
Mail Code: 6401A  
Washington, DC 20460;  
Prepared by: Robert H. Beach, Bruce A. McCarl (Texas A&M University), Anthony Lentz (RTI International),  
3040 Cornwallis Road, Research Triangle Park, NC 27709;  
RTI Project Number 0210826.003,*

Additionally, unlike the emissions estimated by the FASOM model, the international N<sub>2</sub>O emissions have been calculated manually using the IPCC guidelines and Tier 1 default values. In this case there are no emissions calculated for nitrogen fixing crops, other than those related to fertilizer application and crop residues. This is further evidence of the error in the FASOM estimates for soybean production.

### **Layman's Term Explanation:**

When nitrogen fertilizer is applied to crops, excess nitrogen escapes from the soil over time and forms greenhouse gases. With soybeans, the fundamental calculation is different than other plants, because soybeans remove nitrogen from the atmosphere and turn it into valuable nutrients that remain in the soil. This is a primary benefit of growing soy in rotation with corn, because soy reduces the amount of nitrogen that must be applied to the corn crop.

In 2006, the IPCC stated that nitrogen fixed by legumes such as soy, decreases N<sub>2</sub>O emissions relative to application of nitrogen fertilizer for other crops.

<sup>i</sup> The Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program published on page 24909 of the Federal Register on May 26, 2009