In recent years, national promotions for introducing sustainable agricultural production system have been active. The direct payment system for environmentally friendly farming (EFF) has started in 2006 and became an official law in 2015. This aims to secure agricultural production that remains in harmony with the environment by utilizing nutrient cycling function in the nature. This policy also plays an important role to maintain ecological service by agricultural fields to cope with Basic Act on Biodiversity (2008) and the first greenhouse gas (GHG) emission reduction commitments under Kyoto protocol (2008-2012).

The targets of the direct payment system for environmentally friendly farming are the farmers who use less than 50% of chemical fertilizers and agro-chemicals along with one of organic matter; manure or cover crops. However, in the past studies have shown that incorporation of green manure or plant residues increase N\textsubscript{2}O, which has high Global Warming Potential (GWP: 298). But there is little study on greenhouse gas emission in environmentally friendly farming systems. This study aimed to evaluate environmental impacts on greenhouse gas emission from two environmentally friendly farming systems: living mulch system and grass mulch system. Effects on weeding, pest control and crop yields were also evaluated as the integrated assessment of the farming systems.

First, two living mulch systems were compared in GHG emission, weed suppression
and yields. The result showed the wheat living mulch system was able to reduce weed density in the summer. However, high N\textsubscript{2}O emissions were observed in the organic farm with high nitrogen input. N\textsubscript{2}O emission in living mulch treatment was higher than in no living mulch treatment under the low nitrogen input.

Second, incubation studies that applied combinations of four different solutions (deionized water, 1mM-NO\textsubscript{3}, 10mM-NO\textsubscript{3} and 1mM-glucose+NO\textsubscript{3}) and different rates of cover crop powder (0-265kg/10a in dry weight) were performed. There was a significant relationship between soil nitrate concentrations and N\textsubscript{2}O emissions. When the water NO\textsubscript{3} concentration was same, N\textsubscript{2}O emissions in glucose solution or cover crop powder treatments were greater. This might be because nutrients were supplied from cover crops powders to accelerate denitrification as N\textsubscript{2}O.

Finally, GHG emission and pest insect density in Karijiki (grass mulch) system under different tillage treatments and fertilizations were evaluated. The results showed N\textsubscript{2}O and CO\textsubscript{2} fluxes were greater in the following orders: in no tillage with grass mulch system > in tillage with grass mulch system > in tillage with no mulch system. Since the litter bag test resulted the decomposition rate was significantly higher in no tillage system and there was a correlation between water soluble organic carbon contents and N\textsubscript{2}O emissions, these results also suggested grass mulch provided nutrients into soil and created more habitats for soil microbes made denitrification more active. The results of pest traps showed whiteflies (Trialeurodes vaporariorum) density was significantly lower in grass mulch system.

In conclusion, the environmental impacts on GHG emission from these two farming systems were low. By appropriate fertilizer management with a combination of plastic mulch, it became a low cost environmentally friendly farming practice that can be also useful for weed suppression and pest control. This practice could be one of better options for farmers to promote environmentally friendly farming in the future.