Sustainable, Regenerative & Climate-Smart Agriculture

TFI POSITION STATEMENT

Background

Agriculture, or food production, is key to sustaining our world population. However, in its very essence, cultivation or agriculture is a disturbance to the natural world and is a trade-off or balancing act with nature. However, we must acknowledge that without agriculture it is impossible to sustain our world population. Furthermore, the cultivation of the earth enables the development of civilizations; it allows people to give their time to technological advancement rather than growing or gathering food 1. This is why food security through agriculture is truly the backbone of a thriving society and nation. While stable agriculture makes advancements and progress possible, it is a delicate balance to feed the world and minimize impacts to the environment.

Modern agriculture is faced with the challenge of producing enough food, fuel, fiber, and more to sustain our way of life and to protect our environment2. The ultimate goal is to farm in a way that prevents unnecessary impacts on the natural world. Several terms have appeared over the years to help capture the balance of productivity and environmental protection. The terms sustainable agriculture (SA), regenerative agriculture (RA), and climate-smart agriculture (CSA) have all emerged to describe ecologically beneficial agriculture practices. However, the terms lack consensus on specific definitions. SA and RA have been in use since the early 1980s3, and CSA has emerged as a new term in recent years. More broadly these terms refer to practices that provide all-encompassing global solutions to food security, ecological preservation, emission reduction, economic-wellbeing, and biodiversity conservation. As these definitions vary and keep evolving, confusion has grown in understanding the terms and how they differ.

Position

To put any of these terms (SA, RA, or CSA) into practice, we must acknowledge the farmer practices that make agriculture possible. Paramount to agricultural success is adequate crop nutrition through fertilizer applications. It is widely accepted by the scientific community that Haber and Bosch's invention in the 1910's changed the world4. Their technology to produce fertilizer is responsible for feeding roughly 50% of the world's population today5. Since its invention, fertilizer has remained an essential input to sustain our global food supply.

Each unit of soil all over the world has its own unique recipe for the nutrients it should receive. Educating farmers on nutrient stewardship frameworks like the 4Rs – that is, applying the right nutrient source, at the right rate, at the right time and in the right place – helps farmers use fertilizers correctly, so they are not overapplied or misapplied, thus reducing potential for negative environmental impacts. This simple concept can help farmers and the public understand how the right management practices contribute to sustainability for agriculture.

The 4R nutrient stewardship program was spearheaded more than 15 years ago by scientists within the fertilizer industry. Research has found that using 4R practices can achieve large environmental benefits in reducing both water and air pollution substantially. For example, a meta-analysis of multiple field studies found nitrous oxide (N_2O) emissions could be reduced by up to 50% by optimizing fertilizer N rate, source, and timing6. The key to 4R lies in tailoring practices to each climate and cropping system rather than applying a single blanket solution7,8. In every circumstance, use of the 4Rs is integral to accomplish ecologically beneficial farming and is a key element to sustainable, regenerative, or climate-smart agriculture.

Definitions

Sustainable agriculture

Sustainable agriculture caught traction in 1980 when Wes Jackson of The Land Institute used it to describe agriculture that prioritized stewardship of the land3. Today, SA is centered on enhancing three major pillars which align with those guided by the Global Reporting Initiative (GRI) principles 1) environmental health, 2) social and economic stability, and 3) economic profitability.9 SA covers a wide array of agricultural practices to protect and conserve soil and water, increase biodiversity, and improve efficiency on the farm to lead to positive outcomes in each of the three pillars.

It should be noted that failed concepts, such as low-input farming (which led to the failure of pillar two and three, economic stability and economic profitability), are not encouraged in today's SA philosophy. Nutrient, water, and land stewardship are essential elements to SA. The 4R nutrient stewardship practices fall in step with the SA philosophy goals to preserve land and water while preventing detrimental yield loss and economic strain on farmers and our food system.

Regenerative Agriculture

Regenerative agriculture (RA) was coined by Robert Rodale in the early 1980s and carried on by the Rodale Institute to go beyond the aims of SA to restore, or regenerate, the land rather than maintain it from further degradation.10 While the term is often tied to organic farming, it is not limited to organic-only practices. It is often geared towards diverse farms with animal agriculture, like grazing operations. RA has been defined independently by many institutions, but in summary, RA practices focus on using a systems-based perspective to build soil carbon and health, minimize soil disturbance, increase biodiversity, keep a living cover, and reduce pollution.11

While some organizations have suggested RA should include input-free practices11, research contradicts the effectiveness of such methods in practice. Scientists have warned of the potential degradation of soils in going input-free, and that such practices are unlikely to lead to the claimed benefits of RA.10 Furthermore, the RA approach suggesting low input, as with some indigenous land management, leads to low and unsustainable crop productivity that is simply insufficient to feed the world.12 In step with the most current agricultural science, using fertilizer and nutrient stewardship helps to accomplish the philosophical goals of RA while supporting food

security. Fertilizer applications work hand in hand with practices like cover cropping, as it supplies the nutrients necessary to support the main crop. Fertilizer use also helps support crop development in minimum tillage systems aimed to reduce soil disturbance.13 True RA does not turn away helpful tools like fertilizer. Instead, RA embraces all the tools available for sustained food production, soil regeneration, and increased natural biodiversity. The use of 4R nutrient stewardship practices allows for the development of healthy crops and soils, while reducing pollution to water sources and greenhouse gas (GHG) emissions14.

Climate-Smart Agriculture

The term climate-smart agriculture appeared in 2010 to address the concerns emerging from climate scientists regarding agricultural contributions. The term was largely embraced by the FAO (Food and Agriculture Organization)15 initially and has grown popular in the public with the USDA's $2.8 billion investment in Climate-Smart Projects in 2022. Climate Smart agriculture employs many of the underlying principles and practices that are a part of SA and RA through the lens of a changing climate and climate specific impacts.

Like SA and RA, CSA aims to reduce GHG emissions and increase carbon sequestration in agriculture practices. However, while RA and SA are highly focused on the field level, CSA is unique in its focus on the agriculture and food supply chain to reduce the carbon footprint off the farm as well as creating agronomic systems that are resilient to climate change. This relatively new term is not yet well established in agricultural research, though its outcomes and farm practices are highly aligned with SA and RA. This tie to SA and RA goals indicates field level practices should include the 4R nutrient stewardship program in its aims for viable crop production and protection of the environment.

Summary

Fertilizer is a valuable resource and essential tool to achieve SA, RA, or CSA . It replenishes soil nutrients for soil regeneration and provides the life-sustaining nutrients necessary for crops and animals. While agricultural terms will continue to evolve and new phrases will emerge, fertilizer will continue to remain a key ingredient for life and a necessary resource for farmers to feed the world.

The fertilizer industry recognizes sustainable, regenerative, and climate-smart agriculture as approaches that can restore and maintain soil health, reverse biodiversity loss, and increase soil carbon sequestration. With each iteration, these philosophies can and should encompass the latest agricultural research available to improve farming practices. The industry further recognizes these agricultural philosophies as important tools to help further nutrient stewardship practices to deliver positive environmental, economic, and social benefits.

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