Sustainable Solutions: Integrating Conservation Agriculture Practices into School Gardens

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INTRODUCTION

Africa's population remains the youngest in the world, and is currently experiencing a "youth bulge" that contributes to a lack of employment opportunities, causing financial barriers for the continent's youth (UN Economic Commission for Africa, 2017; International Labour Organization [ILO], 2020). In addition to this economic crisis, 27.4% of the population of Africa is severely food insecure, according to the United Nations' Food and Agriculture Organization. This economic and food security crisis requires innovative solutions to engage and educate youth on successful agricultural practices to both create job opportunity, and vibrant and resilient communities (Roberts, et al., 2016).

School gardens have become increasingly favored as an experiential learning approach (Diaz et al., 2018). School gardens show positive effects on students' academic outcomes including science, math, and language arts (Graham et al., 2005; Williams & Dixon, 2013). Additionally, school gardens impact the use of agricultural practices, such as conservation agriculture practices. Aligning with priority questions of the American Association for Agricultural Education research priority questions, the method of using school gardens to teach conservation agriculture practices addresses question one, "What methods, models, and programs are effective in preparing people to solve complex, interdisciplinary problems (e.g. climate change, food security, sustainability, water conservation, etc.)?" and question seven, "How can formal and nonformal curriculum in agriculture and natural resources address emerging, complex issues (e.g. climate change, food security, sustainability, water conservation, etc.)?" (Roberts et al., 2016, p. 6).

HOW IT WORKS

Conservation agriculture (CA) involves multiple procedures to minimize damage to the environment and soil surface (Boa, 2017). The procedures of conservation agriculture are based on three principles including minimal soil disturbance, maintaining a soil cover and using cover crops, and implementing crop diversification through the use of rotation and/or intercropping (Boa, 2017). By using these principles, it can increase soil fertility, maintain soil moisture and temperature, and control pests and diseases (Boa, 2017). Therefore, conservation agriculture is a method that can increase sustainability, assist in water conservation, and mitigate food security.

CA practices were implemented in a senior high school in Ghana as a part of the International Agricultural Education Fellowship Program from The Center for No-Till Agriculture. Students were taught the theory behind CA, witnessed demonstration in the garden, and eventually conducted an experiment comparing the growth and yield of lettuce grown conventionally versus with the CA method. Students used water bottles for sustainable, low-cost drip irrigation and mulching with chopped local plant materials for the CA lettuce beds.

Students witnessed the drip irrigation's effectiveness by its constant, even, and directed water distribution. They also experienced the effectiveness of mulching as it eliminated the conductivity of the suns' heat on bare soil by creating an organic-matter barrier and allowing the soil to retain more moisture during the dry season. Ultimately, the students completed a comparative analysis between conventional practices and CA practices. Students claimed the lettuce grown with CA practices had a better flavor, higher yield, more appealing appearance and in return, brought more revenue than the conventionally grown lettuce.

IMPLICATIONS

The need to be knowledgeable about diverse and sustainable techniques such as CA are vital in developing countries, where smallholder farming is a common practice among agricultural professionals. School gardens are a prime opportunity for students to learn conservation agricultural practices and witness the impacts of CA practices. Africa's potential to combat food insecurity and support its growing, youthful population impacts the world at large. CA practices have the potential to support positive economic change through agricultural development. Additionally, the positive results of CA are easy to demonstrate and disseminate to the ideal population though school gardens. Therefore, the use of CA practices as demonstration and hands-on experience for students has the potential to enhance their potential as agriculturalists because of their understanding of sustainable agriculture.

ADVICE

It is vital to teach the theory, background, and science behind CA prior to demonstration, but even more important to use school gardens for its intended purpose: hands-on learning. We recommend reinforcing the importance and reasoning behind CA practices and coupling the theory with physical demonstration and participation.

After implementing these practices within Ghana Secondary School garden, we recommend creating a competition between student groups, including demonstration gardens with CA and non-CA practices, and being conscious of cultural norms and traditional agricultural practices. This step can be built into existing activities. Competitions between student groups have the potential to increase student engagement with the gardens. They can provide motivation for students to want to participate, while simultaneously learning the content surrounding CA. The competition between students also adds an additional level of excitement to the experiential learning experience that is school gardening.

Demonstration gardens, such as IAEFP's compare CA and non-CA practices which illustrate the positive effects of CA to smallholder farmers. The demonstration plot strategy can be transferred to the school garden setting to easily illuminate to students how CA versus other practices impact the garden's productivity.

It is vital to understand cultural norms and traditional agricultural practices to effectively introduce CA within a developing country. We suggest a participatory approach with students and community members when CA is proposed. This step allows local people an opportunity to ask questions and determine where CA can fit and enhance their agricultural practices.

RESOURCES NEEDED

Conservation agriculture techniques may be applied to a wide variety of both crop varieties and growing spaces. The resources needed to demonstrate conservation agriculture through school gardens are land, or a capacity to grow crops, seeds or seedlings of crops, basic gardening or farming tools, access to water, and knowledge of conservation agriculture practices used in the specific country or region it is being applied. Garden space can be allocated or donated by a school or third party. If land is not available, raised beds, container gardens, or bagged crops can be utilized. Seeds for crops, and cover crop plant varieties if needed, as well as supplies and water access' costs may vary depending on availability and location.

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