INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 2 ISSUE 2 (2016) PAGES 687-693
RECEIVED : 18/03/2016. PUBLISHED : 25/03/2016 March 25, 2016

HORTICULTURE MANAGEMENT SYSTEM

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Abstract:

Affordable greenhouses have been proven to substantially increase crop yields by allowing farmers to grow year-round while, at the same time, decreasing water consumption. These benefits translate to improved livelihoods and food security for urban farmers and improved nutrition for their rural counterparts in resource-constrained areas. Accordingly, affordable greenhouses have been introduced to experienced and novice farmers in Kenya, Rwanda, Cameroon, Mozambique, Zambia, and Sierra Leone. Across these countries with different horticultural traditions, educational infrastructure and agricultural extension systems, there is a distinct knowledge gap on the basics of greenhouse farming. Even those who have previous farming experience need to rethink their strategies in order to transition more efficiently from conventional open-air farming to greenhouse farming. This problem has created the need for a comprehensive and context- appropriate decision-support tool to guide farmers through a series of questions across four phases of greenhouse operations: preparation, planting, nurturing, and harvesting. This article describes a highly visual decision support tool that educates farmers about important considerations and helps them make informed horticultural decisions. It also provides case studies for commonly grown produce like tomatoes, bell peppers and greens. This tool can be deployed on a computer, a tablet, or even a three-ring binder, and has been co-developed with, and validated by, farmer groups in Zambia.

Keywords—Greenhouses; food security; smallholder farmers; knowledge gap.

1. INTRODUCTION

With a population of 9 billion people expected by 2050, the earth is facing an unavoidable increase in demand for food. In order for the population to continue to prosper, this increase in demand must be met through the sustainable intensification of agriculture. The capability to produce more food on less land, while also reducing negative environmental impacts, is crucial to the populations' well being and survival [1]. In an effort to combat these challenges, greenhouse technology serves as a simple, yet practical, solution In addition to helping address system-wide concerns over food security, greenhouse technology can facilitate improved livelihoods for many smallholder farmers. The low initial investment and rapid rate of return makes greenhouses extremely attractive [2]. Many farmers have adopted the technology due to its ability to bring higher economic returns in comparison to open-air agriculture [5]. In locations such as China, greenhouse adoption has boomed, making up over 90% of all global greenhouse vegetable cultivation in the world [2]. These greenhouses have doubled crop yields by extending growing seasons and increased the income of many farmers. Greenhouses also provide ecosystem benefits such as lower water consumption and improved soil protection [2]. These benefits, however, are harder to realize in countries in Sub- Saharan Africa, where such technology is unique and previously out of reach to many farmers. In Zambia, many rural farmers interviewed about the potential use of greenhouses, found the idea of farming in a greenhouse irrational. and higher chances of success can be obtained [7]. Integration of indigenous practices will help bridge the knowledge gap of farmers who are transitioning to greenhouse farming.A decision support tool can facilitate a successful translation process. The decision support tool proposed in this paper provides a series of questions that spans the four phasesof greenhouse farming operations in one harvest cycle: preparation, planting, nurturing, and harvesting. It is a highly visual guide that lays out case studies for many different commonly grown produce such as tomatoes, bell peppers, and greens. This tool allows farmers to move through the agricultural process of greenhouse farming with ability to make more informed decisions. This tool will be disseminated simultaneously through two methods: a paper copy and a PDF version that can be downloaded and read on a computer, Smartphone, and e-reader.This article outlines the context and challenges of addressing educational barriers, a description of the tool, its validation process, its sample-use scenarios and its limitations. The successful diffusion of greenhouse technology and its adoption depends heavily on overcoming abroader educational barrier. Watering, crop spacing, and time till harvest all differ in greenhouse farming when compared to open-air farming. The failure to address the distinction between greenhouse and open- air farming has created a knowledge gap. With many current and potential users lacking a basic understanding of how greenhouses address their specific needs. Farmers must obtain such knowledge in order to utilize this technology to its utmost potential. A study conducted in Kenya revealed that educational levels, experience with greenhouse farming, and number of extension staff farm visits, all had a significant effect on greenhouse performance [7].Users of greenhouse technology vary from those with substantial experiences with open-air farming to those who have had very little. The overall success of greenhouse users is largely dependent on the outcome of the learning process. What is missing across the board is a framework that integrates both greenhouse and open-air farming knowledge, and successfully transitions users towards greenhouse horticulture practices.A method to understand, aggregate, and standardize a process of greenhouse farming should utilize comprehensive and context-specific approach. Understanding the current horticultural practices, or indigenous practices, of varying locales is vital. By engaging smallholder farmers and observing their current farming techniques, greater adoption rates of greenhouses.

2. CONTEXT AND CHALLENGES

Greenhouse technology has not been successfully adopted on a wider scale in Sub-Sahara Africa, causing many farmers to miss the opportunity and practicality of greenhouses. This reflects a largely neglected opportunity to address the knowledge gap. In the Gusii highlands of Southwest Kenya, farmers have abandoned greenhouse farming after the first crop cycle, despite having initially invested in the technology [6]. This abandonment of greenhouses is becoming a larger trend. In Nigeria, a survey was conducted to assess the barriers that caused greenhouse abandonment in many parts of the country [8]. Nigeria housed many greenhouses exclusively for research purposes. The attempt to encourage locals to transition to using greenhouses as a means of augmenting their income was unsuccessful. Merely introducing previously out- of-reach technology to farmers is not sufficient to guaranteeing proper understanding and utilization. The lack of initial effort to understand both the existing practices and the needs of farmers prevented many in Nigeria and Kenya from transitioning to greenhouse farming. Greenhouses in many of these contexts are unaffordable and unfamiliar to the local community. If these issues are not successfully addressed, they can act as barriers that perpetuate an even larger knowledge gap between farmers and greenhouse technology. The process of knowledge transfer should be geared towards the farmer and farming practices, rather than the just the technology itself, in order to overcome abandonment [5]. Indeed, additional knowledge and skills that greenhouses require in the agricultural process may act as an opportunity for a scalable solution to address local needs. In Tajikistan, a woman's cooperative in an area with natural disasters, built and farmed small-scale greenhouses. These greenhouses served as a mechanism for women to gain skills such as first aid and disaster management. Truly understanding the livelihood dynamics will allow for the contribution of a particular technology to aid changes desired by the farmer [5]. Both disaster management, which was a distinct need of the community, and food security, were simultaneously addressed through the utilization of greenhouses. As a result, many women became fully prepared and capable of handling disaster-related situations such as landslides and earthquakes [9]. Leaders in the community maintained a cyclical transfer of knowledge as these women taught other women-a justifiably more sustainable method of integrating indigenous and greenhouse farming practices. The design of such knowledge management practices lead to project success.A system of knowledge transfer between the designers of greenhouses and the individual farmer can ensure higher rates of adoption. Agricultural technology succeeds in accordance to the extent of the farmer's involvement in the process [5]. When treated as experts of their own techniques, farmers enable multiple pathways for dissemination. Non-formal educational systems such as night schools, radio, television, print media, and mobile phone applications are all ways to translate these new techniques [10]. These pathways ensure that the technology incorporates the needs of farmers by delivering a more context-specific approach. Restructuring the learning process, from merely giving farmers greenhouses to taking the initial time and effort to enable greater understanding of the technology, is much more conducive to greenhouse user success. Through these methods, the capability of farmers is expanded. The ways in which extension agents have been communicating with farmers is currently being revolutionized with technologies that increase ease of promoting various informational networks. Many applications and services have been created for this sole purpose, allowing extension agents to have multiple ways to communicate and interact with farmers. An example of the potential success of the impact of these methods of dissemination is the success of the organization Digital Green. That provides information through a mobile platform, which has been proven to be 10 times more effective than traditional extension service practices. They have currently produced over 3,700 videos In 20 languages, and reached over 640,000 community members. Their services can be accessed through smart phones, tablets and computer [4]. This organization has proven the success of such dissemination methods, validating the method of using e- readers and publishing the tool on the website. This method of dissemination can enhance communication, and improve the delivery information system. Many of these communities with experienced farmers have survived thousands of years through indigenous farming techniques. Greenhouses should be utilized as a means to safeguarding such knowledge. This technology can act to preserve indigenous crops. A system of knowledge transfer should not disregard such practices, but provide additional knowledge of greenhouse horticultural practices. Applicable and context-specific techniques must be recommended to the farmer in place of predetermined and general techniques [5]. An extension agent is typically hired by the government to travel to farms and provide support for their agricultural needs. Such factors are an integral part of the knowledge process. Farmers, through systems of knowledge transfer, can act as development partners in conjunction with extension agents, who simply act as catalysts of the transition process. This distinct approach equips farmers with the skills and knowledge required to make decisions on their own production of resources, ultimately aiding in profitable and sustainable results [10].

3. DESCRIPTION OF TOOL

The goal of the decision support tool is to overcome the knowledge gap that both novice and practiced farmers commonly face with greenhouse technology, specifically in the African context. Through the provision of a comprehensive and context appropriate decision-support tool, farmers will be guided through over 40 decisions formulated as questions. These questions span four general stages of faming: preparation, planting, nurturing, and harvesting. A user-friendly and context specific approach is taken to meet the needs of new greenhouse users.

Fig.1. Preparation Slide Directing Users Towards Relevant Soil Testing Methods

The tool acts as a master layout of all the decisions farmers consider as they move through each stage. Information will be available to the farmer, regardless of the decision he or she makes. Those greenhouse users, who have access to soil testing for example, have a different decision to make, than those who do not have access to such recourses. Two types of questions can be found: those that are general to farming, and those that are specific to the plants chosen to grow. Information is provided on three major crops that farmers in that region tend to grow: tomatoes, greens, and peppers. The design process of the tool prioritized adaptability and scalability. Adaptability allows this tool to encompass differing needs and resources available to users. Scalability allows more crops to be added in the future when deemed beneficial.

A.Preparation

Farming, and without proper attention to important nutrients there is an increased risk that plants will not flourish and be productive.One of the first decisions farmers need to make is what plant they intend to grow. Different plants and varieties will dictate the length of growing seasons, the amount of water and nutrients needed, and differing nurturing techniques.

Fig.2. Preparation Slide Giving Advice on Choosing Tomatoes

Once this is decided, farmers must determine what types of plant beds they will utilize. In-ground beds involve making elevated soil rows, and usually are the best option to utilizing space inside the greenhouse. The choice however remains with the user, and the information is presented in a table that differentiates the benefits and the costs of each bed type. Greenhouse spacing is one of the crucial differences in comparison to open- air farming. Greenhouses allow a greater amount of crops to be grown in a defined area compared to traditional farming, as the crops can be spaced closer together. With many open-air farmers unfamiliar to the new spacing requirement, they remain unable to utilize such a distinct benefit. A convenient layout is presented, showcasing the number of crops and the spacing between each of those crops in a 6-meter by 5.5-meter area.

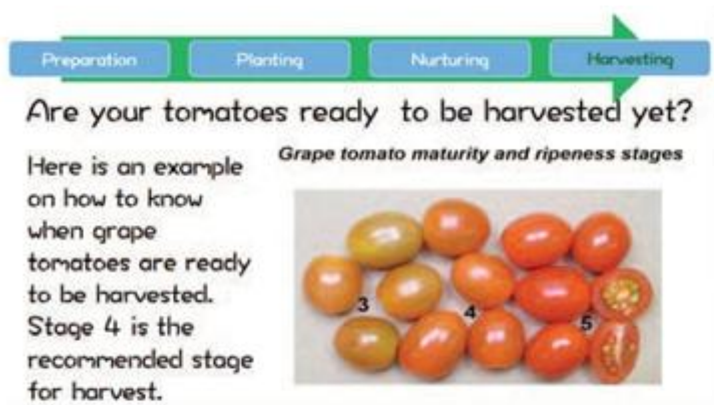

Fig.3. Harvesting Slide Showing When To Harvest Tomatoes Based On Color

Once farmers make these decision it is time for them to begin cultivating the land to ensure proper nutrients are added to the soil. Adding the correct nutrients based on plant needs will greatly increase odds of success. In areas in Zambia, the soil can be more clay-like, while in other locations it is grainy and sandy. These differing soil types require the farmer to respond in a different manner; for instance, sandy soils require more organic matter compared to soil composed of more clay. With many rural farmers unable to access affordable soil testing equipment, it becomes difficult to identify what nutrients must be added. To circumvent this problem, the decision-support tool supplies information on plant characteristics that act as potential indicators of nutrient deficiencies, this can be seen in figure 4. Regardless of whether or not soil testing is utilized, specific nutrients need to be optimized for the plants farmers intend to grow. Farmers need to be aware of the nutrients plants require at their different stages of development. For instance, a starter fertilizer high in phosphorous is recommended at the time of planting to promote proper root development. If fertilizers are not accessible, local materials can suffice. Manure, compost, and wood ash are low-cost available remedies for altering nutrient contents. In spite of unavailable fertilizer, these are still viable, true and tested methods of improving soil quality. Aged manure and/or compost have been proven to provide adequate nutrients for most plants.

B.Planting

Once important nutrients are added to the soil and the land is tilled, farmers are ready for the planting stage. In this phase farmers are guided through six questions to help them maximize the potential use of their land by teaching proper spacing and planting techniques. At this point farmers need to consider the benefits of a nursery bed. Nursery beds are created to germinate seedlings, which will then be transplanted to their final destination. The nursery bed helps ensure that proper nutrients are supplied to the vulnerable seedlings. This saves water and other materials because they only need to be applied to the small seedbed areas. Additionally, planting approximately 20% more seeds than necessary, farmers can choose the best seedlings to transplant. Instructions and advice are supplied for farmers who are unfamiliar with the spacing needed for seeds and plants. Spacing can affect the quantity and size of the fruits produced by plants and needs to be considered. in the early stages of growth and continue to monitor until harvesting. Farmers should check their plants weekly for possible pest and disease damages. White flies, for instance, tend to live on the bottom of tomato leaves and can devastate tomato plants if not promptly identified and treated.

Proper weeding and disposing of plant material can prevent white flies, as well as other pests. Old plant debris can serve as a breeding ground for these pests. In the nurturing phase farmers should also consider the benefits of de-suckering and de-foliage. Suckers are side- shoots that grow in the crotch between the stem and branch of certain plants. It is recommended to remove the suckers from indeterminate tomato plants because excess foliage can burden the plants. De-foliage is a technique that serves a very similar purpose. De-foliating plants involves removing leaves below fruits in order to decrease foliage. Excess foliage can promote wet conditions that lead to fungal diseases. Furthermore, suckers and foliage use up nutrients that could be going to fruits, resulting in smaller yields. Watering is another critical aspect throughout all stages of plant development and needs to be reconsidered for the context of greenhouses. Recommendations are provided for traditional watering techniques and drip-line irrigation. Recommendations take into account water savings to limit the burden on farmers in resource-constrained settings.

CONCLUSION

This decision support tool is an initial step for increasing the access that greenhouse users have to vital information that will guide them through relevant decisions. Additionally it will add to the successful and sustainable adoption of greenhouse technology, as it mitigates the risk smallholder, and novice farmers inherently face. In the future this tool could encompass a greater variety of crops, supporting the most popular crops being grown. This will include features that promote greater potential for lateral knowledge sharing. Seeking to promote greater farmer-to-farmer interaction. This would create a wider community of greenhouse users that will act as a support system to help them succeed. With the availability and accessibility of a decision support tool greenhouses can be widely adopted, with greater support and less risk. To combat imperative issues of food security that our world faces as the population continues to grow.

REFERENCES

[1] H. C. J. God fray , et al, "Food security: the challenge of feeding 9 billion people," *Science*, 327, pp. 812-18, 2010.

[2] J. Chang, et al, "Does growing vegetables in plastic greenhouses enhance regional ecosystem services beyond the food supply?" *Frontiers in Ecology and the Environment*, pp. 43-49, 2013.

[3] W. Bin and L. Zhang, ”Farmer innovation diffusion via network building :a case of winter greenhouse diffusion in China ,*”Agriculture and Human values*,vol.30.4,pp.641-651,2013.

[4] Food and agriculture Organization of the United Nations, Economic and Social Development Department ,Gender, Equity and Rural Employmen Division ,”FAO and Traditional, Knowledge :the Linkages with Sustainability ,Food Security and Climate Change Impacts ,”Food and Agriculture Organization of the United Nations, 2009.