"Agribusiness Essential for Food Security: Empowering Youth and Enhancing Quality Products"

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An Assessment of the Extent to which Farmers Use Modern Technology to Improve Crop Production Value Chains in The Bahamas

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Abstract

Smallholder farms in The Bahamas generally produce as much as they can to sell to the Produce Exchange and other local markets. Much of the produce grown is of inconsistent size and inconsistent quality which causes it to be rejected by the market and consequently disposed of. This speaks to a breakdown in the Bahamian agricultural value chain which should negate wastage by relating the ultimate consumer's demands to a farmers' capability to produce. Value chains are essential linkages from purchase of inputs, land preparation, production and consumption that connect consumer demand to various agricultural enterprises. If Bahamian farmers were to effectively use the internet, cellular phone technology and research to improve production, efficiency would be increased, crop harvest increased and value chains strengthened. The necessary data for this research were garnered from farmers' responses to a 13-question survey. The farmer's names were extracted from the Ministry of Agriculture's Farmers Register using a systematic random sampling selection process. Each farm was then rated as having a high, medium, or low level of technology usage in crop production value chains. Most Farmers in the Bahamas have a medium level of modern technology use. Improvements in seed selection, crop selection and research dissemination are needed.

Introduction

Contrary to popular belief agriculture is a business. When well-planned and well executed, agricultural activities can improve the economic outlook of individuals, communities and countries. Agricultural activities can also contribute to equity in food distribution or food security of a country. One way to expand the benefits of agriculture is with the introduction of improved technology into the sector, especially at the primary level of production in the crop value chain.

According to Boehlje, Hofing and Schroeder (1999) "pressures for [value] chain formation appear to surface in a three phase sequence: 1) capturing inefficiencies and controlling costs, 2) reducing risk (quality, quantity and food safety), and 3) responding to consumer demands for attributes". This research aims to locate inefficiencies arising from ineffective use of technology and suggest solutions to these shortcomings to strengthen the Bahamian crop value chain. The potential benefits of such improvements are manifold.

Use of improved technology can help to alleviate inefficiencies in crop production. Farmers will be able to maximize the use of inputs they already possess. Technology use also helps to make agriculture more attractive to young persons as the industry becomes modernized, more structured and more profitable. By using modernized agriculture as a tool for profitability this industry can be used to diversify the Bahamian economy. Undoubtedly, one of the most important reasons for improved technology is needed is to improve crop production value chains and aid in national food security. Internationally, many farmers are using the internet and cellular services to increase both efficiency

and profit. In light of this, the question arises, to what extent have technological developments been used to positively affect domestic crop value chains in The Bahamas?

For the purposes of this paper, an agricultural value chain will be defined as all those on farm activities and services which combine to add value to primary inputs to provide an end product that is produced according to consumer demand. This definition seeks to narrowly focus on only those activities that enable production of the primary product and excludes other value adding processes that involve packaging, transport, marketing or any other tertiary activities.

When referring to modern technology advancements this paper will refer to activities such as, Information Communication Technology (ICT) such as telephones and internet resources. These can include farming blogs, Geographical Information Services, Decision Support Services and research from accredited university agricultural resources (websites, blogs, Facebook, YouTube etc.) all of which are gaining international popularity within the farming community as they can improve the farm‟s products thereby adding value based on consumer demands.

To determine to what extent Bahamian farmers are using modern technology in crop production, a rating scale was developed and used to evaluate registered farmers on the islands of New Providence, Abaco, Andros and Cat Island. Based on set criteria, each farm was given a rating of high, low or medium as their level of technology use. Based on this, recommendations for advancements that can be incorporated to improve the farming industry are provided in this paper.

Without a doubt agriculture is inextricably linked to the national food and nutritional security of a country. This fact is no less true in The Bahamas. As such this research will aid in national development and is in line with the present government‟s manifesto to “grow what we can, buy what we must” to reduce the nation‟s $500 million dollar food import bill (PLP 2012). Improving the technological investments Bahamian farmers make in their crop enterprises will undoubtedly improve the quality of the products they produce and ultimately increase profits. Finally, this research will add to Bahamian literature about the development of agriculture in The Bahamas and will also fill the gap in research literature regarding the functioning of the Bahamian agricultural crop value chains.

Literature Review

Agriculture is an industry that is constantly changing and evolving. However, issues such as “poor infrastructure, unproductive growing techniques and a lack of technology” plague many small holder farms and limit their productivity, profitability and ability to expand (This is Africa 2013). To curb this problem of low productivity and reduced efficiency, the use of improved technology is essential. The purpose of this research is to explore the extent to which farmers in The Bahamas are using modern technology to advance and improve their business. The use of such technologies is gaining steam throughout the agricultural community as a means of improving production value chains. Strengthening value chains is critical to assisting smallholder farmers in accessing new markets and improving environmental sustainability (Hailu 2013).

Implementation of improved technology to produce crops is essential. The improved technology need not be highly technical or expensive. It can be as simple as consulting readily available meteorological data to mitigate against pest infestations. Such considerations are confirmed by Houseman who cautions that any attempt at improving or introducing more information and increased technology should result in a solution that is simple, cheap and effective to operate (nd). This is important because there is little utility in increasing technology if it is complicated and the farmer is still unable to either operate or afford the new technology. New technology should not be designed to further complicate the farmer‟s business. Instead it

should serve to produce more output with the same level of input (Casavant, Infanger and Bridges 1998).

In addition to the solution being affordable and appropriate for the farmer, the solution should also be focused on customer demands and not just the farmer‟s ability to supply the market. In research conducted on African poultry value chains Asem-Bansah et al. also found that "the general low production and disregard for market demands by industry actors have negative influences on performance" (2012). These assumptions also hold true for crop farming, for if customers do not want what the producer is selling it results in markets being flooded with products that customers do not want to purchase. Farmers are therefore unable to get premium prices for crops produced and the investments made do not pay off sufficiently as products do not match the wants of the customer.

Globally investments in improved technology and increased knowledge are being conducted with the full support of farmers. In a study conducted by Bagachwa et al. cited by Rahko (2012) farmers actually demanded more courses and study tours to increase knowledge and improve their crop production methods. Such is also the case in The Bahamas where farmers, regardless of age, welcome courses on their various islands to help them improve their agricultural enterprise.

In 1985 Michael Porter wrote a very influential book entitled Competitive Advantage: Creating and Sustaining Superior Performance. In this book Porter proposed the idea that companies could gain a manufacturing competitive advantage over their competitors by investigating how value can be added through value chains. In this book Porter essentially divided a company‟s value chain into Primary and Supporting activities. Primary activities included inbound logistics, operations, outbound logistics, marketing/sales and service; supporting services in the value chain included procurement, technological development, human resource management and firm infrastructure (Porter 1985). At each of these stages value is added to the primary product to create a commodity that the ultimate consumer is willing to purchase.

The importance of value chains is again gaining increased popularity as a means to improve agricultural production systems. As such, it is necessary to clearly define what a value chain is. There are various definitions that have been proffered as to what is a value chain. The agricultural periodical entitled Spore defines a value chain as "a sequence marked by value growth and coordination at each stage of production, processing and distribution, driven by consumer demand. It carries with it a range of support functions, such as input supply, financial services, transport, packaging, market research and advertising" (CTA 2012). This definition is a catch all for each segment of the value chain, however it is too broad for the purposes of this paper.

According to the organization Value Chain Initiative a value chain is "an alliance of enterprises collaborating vertically to achieve a more rewarding position in the market" (Ag and Food Council 2004). While succinct and convenient, this definition is too simplistic to capture the other external factors that can influence how strong or effective a value chain can be. Ian Ivey however provides an outline of value chain players which includes the role of research and development, government agencies and the private sector all collaborating with a distinct focus of satisfying the demands of the customer (Ivey 2008).

Wilkinson defines value chains as "the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use" (Wilkinson 2006). This definition provides a more comprehensive definition of the elements in a value chain but does not directly state that the value is added at each of the various stages. Similarly, the FAO

gives a succinct definition of value chains as "the set of actors and activities that bring a basic agricultural product from production in the field to final consumption, where at each stage value is added to the product" (FAO 2010). The FAO‟s definition provides a good general definition of what a value chain can be without confusing the matter but lacks specific information that would assist the novice reader in easily identifying specific elements in an agricultural value chain.

Since it was first popularized, the concept of the value chain has also be applied to other fields such as agriculture to help farmers take a fresh look at how they produce and how they can improve their product‟s quality. Farming in The Bahamas has advanced considerably from the days of pure slash and burn. Of particular concern today though is how to gauge exactly the extent to which the support activity of Technological Development, as outlined by Porter, has been impacting Bahamian crop production. This paper will seek to determine how technological developments have been integrated into production methods and decisions and what effect this has had on farmer‟s productivity and the overall agricultural value chain.

The issues of food production are gaining increasing attention throughout the world. Many factors however impact upon the crop value chain that improved information technology can assist farmers with. Miller, Saroja and Linder (2013) contend that short term productivity can be increased with technology by receiving weather information and in the long-term farmers can receive training with proper fertilizer and chemical usage, crop protection and crop rotation techniques. For example in India project e-Sagu was initiated to enable farmers to receive "planting, monitoring and harvesting…pesticide and fertilizer usage based on digital photos taken by the farmers themselves; in Turkey five weather sites were established and now are used to provide farmers with information regarding when pests are likely to be most prevalent; farmers receive this information via cell phone and have been able to reduce their use of pesticides by 50 percent (Miller, Saroja and Linder 2013). If such tactics can be utilized in The Bahamas to cut inorganic pesticide use undoubtedly farm expenditures will be greatly reduced. In India a Virtual Academy was established to assist women to overcome the consequences of pests and periods of drought; AGRISNET was introduced in India to act as a web-based portal for farmers to share information regarding weather, quality requirements and available benefits available for farmers (Miller, Saroja and Linder 2013).

Trienekens (2011) refers to work by DeJanvry and Sadoulet, Daviron and Gibbon along with Reardon and Barret to confirm that small-scale farmers are at a particular disadvantage because they have little capital to invest, they use traditional techniques and depend on family labour. Such factors limit the farmers‟ ability to expand and therefore keep them trapped using dated techniques which stagnate progress. Such issues also affect Bahamian farmers which is why investment in improved technology and better usage of available technology will greatly assist Bahamian farmers in increasing quality, increasing efficiency and decreasing expenditures.

The need for such improvement to strengthen the Bahamian crop production value chain from primary processor up the chain is vital. The Bahamas has made plans to accede to full World Trade organization (WTO) membership by 2014 (Virgil 2012). As a part of WTO requirements specific Sanitary and Phytosanitary regulations will have to be abided by in order to fully benefit from WTO membership and gain access to markets. One of the ways this can be achieved is through improved record keeping and through improved technology use. In addition to this better use of Information Communication Technology (ICT) will enable farmers to seek out better inputs such as seeds and fertilizers which appeal to a certain niche markets such as organics. Additionally, with the looming threat of the increased severity of Climate change, improved

technology can help farmers plan cropping times and decrease crop destruction due to weather patterns.

With better use of cellular phones, landlines, internet and research, farmers can improve their business and reduce crop losses and essentially financial losses due to lack of information and wasteful use of inputs. Improved technology will improve productivity as this will open farmers up to markets overseas where they can purchase improved products and reap improved harvests.

Materials and Methods

To achieve the research objective a 13-question survey was devised. This survey was conducted with farmers on the islands of New Providence, Abaco, Andros and Cat Island over a period of two moths from March 2013 to April 2013. This research does not include all the islands in The Bahamas, only a representative subset. These islands were chosen to carry out this research because they met the criteria of either currently having a packing house/Produce Exchange or once had one of these institutions. The presence of either a Packing house or a Produce Exchange is significant as it speaks to a high volume of agricultural production on the island.

To garner the required information, the Official Farmer‟s Register was obtained from the Ministry of Agriculture and Marine Resources (MAMR). Only persons who are currently eighteen years old or over and registered with MAMR were allowed to complete the survey. Also only persons currently farming crops were included in the sample. All individuals who have added livestock to their product mix were excluded from this survey. It is only the extent of technology usage at the production stage and the strengthening of crop value chains that will be examined in this research.

Being that the Farmer‟s Register did not include contact information for the listed farmers, the names on the list were cross referenced with the 2013 telephone directory to access contact numbers. Calls were made to these farmers either in the morning from 8am-10 am or in the evening from 5pm-8pm when farmers were more likely to be at home and able to answer questions.

Sensitive information relevant to business operations such as supplier‟s names, production techniques were required for the completion of this research. All such information was handled ethically and will remain confidential. No one was forced to participate in the study. All participation was voluntary. Respondents also had the option to skip questions they felt uncomfortable answering.

Some of the questions asked have been modified from a similar study conducted by Juhani Rahko for the completion of a Master Thesis entitled Potato Value Chain in Tanzania. Other questions were also posed during the course of the conversation with the farmers. The farmer‟s replies to the modified questions were scored and given a rating using the rating scale devised for this research. Each criteria (cell) received a score of 1 (very low use), 2 (medium use), 3 (high use) and the scores were tallied. Each farmer then was given a technology use rating of high, low or medium based on the five criteria listed in the first column of Table 1. The rational behind these designations is given below in Table 1.

Results

Each of the interviewed farmers was asked the 13 questions presented in the survey. During the telephone conversations other supplementary questions were asked as well. 210 telephone calls were made to the four islands. Fifteen interviews had to be excluded because the farmers were retired, deceased or have included livestock into their operations. Exclusions of 166 individuals were also made because their telephone numbers were out of service, there was no answer on the line or the individual was not a farmer. After all exclusions were made 29 viable candidates remained for survey.

Of the respondents to this survey 58.6% were in the age category of 61+ yrs., 31%

were in the 51-60 yrs. category, 6.9% were in the 41-50 yrs. category and 3.4% were in the 21-30yrs. category. Females made up 48.3% of respondents while 51.7% males comprised the remainder of respondents. The average (mean) farm size was approximately six acres with approximately three acres currently cultivated.

The farmers interviewed were cultivating a wide variety of crops throughout the islands. The farmers interviewed grew the crops shown in Table 2. Many of the farmers were growing the same crops. Only two farmers on New Providence and one farmer on Andros was growing specialty items that customers asked them to grow such as swiss chard, collard greens, bok choy, scallions, kale, mint rosemary and arugala.

When asked question six, if they would be willing to enroll in a course to learn improved farming techniques, 75.9% said yes and 24.1% said no. A program lasting for a half day was preferred by 50% of respondents, 25% would like a program that lasts for more than four days while 12.5% each preferred a half-day program or a 1-day program.

Question seven asked farmers if they currently subscribe to any agricultural magazines, 92.6% replied no, while 7.4% replied yes.

Question eight of the survey asked farmers what would convince them most to try a new crop production method as shown in Figure 1 below, 44.4% replied that if a fellow farmer used it first they would be most convinced to try it.

Question nine asked farmers the identity of the extension officer for their island. Most persons were not aware of what an extension officer was and did not know who the officer for their island was. In Andros however, the majority of farmers knew who the officer was and had regular contact with him. Those who knew the extension officer, expressed a high level of confidence that the information provided was current and accurate (82.4%) as depicted in Figure 2.

Of those surveyed 75.9% were not a part of a co-operative, marketing board or crop authority while 24.1% were. The associations that the 24.1% were a part of were the North Andros Farmer‟s Association. The North Abaco Farming Association, the Cat Island Farmer‟s Association and the Abaco Co-operative. When asked if they believed that the organization was effective in assisting farmers 85.7% of respondents said yes while 14.3% said no.

When asked the final question of how they determine which crops to grow, almost all respondents replied that they plant according to the season. Only three farmers noted that they plant what consumers have asked them to grow. Approximately 7% of respondents purchase inputs such as seeds and fertilizer directly from overseas. The remaining farmers purchase seeds from local sources such as the Mennonites in Andros, the Fish and Feed Farm Store at Potter‟s Cay dock, Cleanway Chemicals Janitorial & Agriculture Supplies in Nassau or they save their seeds from previous crops. When determining how to harvest crops farmers stated that they do not keep written records. They simply remember what they planted and observe the crop or feel the fruit to know when it is ripe and ready to be harvested.

When asked how they determine what crops they will plant each season many farmers replied that they plant according to the season, the moon or whatever crop they have seeds for and hope that customers will buy them. Some farmers also noted that some of the seeds they have been purchasing from the Fish and Feed Farm Store have failed to sprout which causes them to question the viability of these seeds. Farmers also expressed little control over the amount of water and fertilizer each individual plant receives. One farmer noted that he sometimes applies fertilizer according to recommendations from workers at the local packing house other farmers relied heavily on experience and observation while one farmer mentioned that she just buys what she can afford and applies it to the soil.

Very few farmers are using drip irrigation or targeted irrigation techniques of any kind. Instead they are relying on hand watering or natural precipitation. The vast majority of

farmers were unaware of companion planting and planted crops merely according to space, seed availability, equipment availability, rainfall and experience.

The average technology score of the farmers survey was 7.07. The rating was scored out of a total of 15 points, therefore The Bahamas has a medium level of technology use, with some farmers using the internet and cellular phones for farm use. Many farmers are also taking advantage of extension officers who offer their services to producers.

Discussion

Currently the majority, 58.6%, of farmers in The Bahamas are elderly in the 61 and above age category. Many of these individuals have been farming for many years, having been taught by their parents. While still physically and mentally strong many farmers expressed sentiments such as “Stick with what you know” when asked about changing the way they farm. This suggests that they are very averse to changing the way they farm at this stage as it has been giving them a consistent measure of success in the past. There seems to be an inverse relationship between

The Bahamas‟ medium-low technology use score and the age of farmers. The higher the age, the lower the technology score. This age phenomena suggests that for the Bahamian technology use score to increase there must be a simultaneous decrease in the age of farmers.

Another factor contributing to the medium-low technology score seems to be that only 7.4% of farmers are using current agricultural magazines to improve their business. Instead the majority of farmers are relying on past experience and advice from fellow farmers. While 82.4% of farmers are very confident in the advice extension officers‟ offer, the technology being shared with farmers appears to be very limited. This speaks to a breakdown in the input of technology from the Ministry of Agriculture to local farmers. This suggests that local Extension Officers need to be more involved in continuous improvements by attending conferences and updating courses. Farmers also need to become more knowledgeable about the improvements in agricultural production and rely less on lessons learnt decades ago. One means of doing this is through the use of text message updates. These can be easily accessed and requires very little if any increased use of technology on the part of the farmer.

In the world some large scale farmers are using Decision Support Systems and Geographic Information Systems to improve their business. While it is not financially feasible for smallholder farmers in The Bahamas farming on an average of 3 acres to invest in these expensive systems, there are some forms of technology that can be employed to assist local farmers. Since 85.7% of farmers are confident in the advice they receive from their co-operative these organizations should be targeted as points of information dissemination. Through these organizations farmers who may not be able to utilize the internet can receive timely information regarding availability of certified seeds, low cost and environmentally friendly fertilizers. Such reduced cost reduces expenditure and will help to add value to the crops being produced as they can now be marketed as biologically friendly. This can also better aide farmers in planning for the future and predicting what levels of production they can expect given a particular set of conditions. In addition to acting as a research dissemination point, co-operatives can also serve to link these modernized producers to processors who require improved and ecologically sound produce.

Being that the majority of farmers are planting according to seasons, as seen by their replies to question 13, this results in gluts in the market as the majority of farmers are planting the same crops at the same time. As such, farmers need to be trained as to how they can stagger their planting and learn to plant based on customer demand and not based solely on seasonality, tradition and seed availability. This will increase the value of the produce being grown and add to the

farmer‟s profits as he/she will now stand out in the market as a producer of a unique and demanded product. In addition to that, better communication among farmers is needed in order to have an exchange of information so that planting times can be better managed among the islands.

Being that of 22.2% respondents said that the findings of a university study would convince them to change their methods of production, it would be beneficial for The College of The Bahamas (COB) to begin research into various agricultural areas starting with sees viability testing. Some of the respondents noted that the quality of the seeds purchased from the government have been unsatisfactory at times. Evaluating the germination time of seeds available from the government in comparison to other brands of seeds could be a possible area of research undertaken. These results can be disseminated via seminars or classes held on the various islands. When asked if they would be willing to attend a course 75.9% said that they would especially if it lasted for half-a day on the island the individual lives on. This shows that despite the advanced age of some farmers they are still willing to entertain new production methods.

Research by COB can also assist farmers in coming to have the seeds they save as certified by the government which would open up a new avenue of production for farmers. This would also promote a stronger relationship with both processors and the ultimate consumer because there is increased traceability with the crop production value chain. Also by availing themselves of simple technological improvements such as improved water husbandry, choosing better crop varieties, inefficiency of water use, reduced yields can be eliminated from the production value chain.

New technology research can also include the use of companion planting which would help to reduce farmer‟s current heavy reliance on pesticides. Companion planting lets the crops work to support each other, reduces toxins in the soil and adds value to the product as it can now be marketed as an environmentally sound product. This strengthens the link in the production value chain as the need for pesticides is reduced and crop health is increased. This helps to ensure that farm machinery and human resources are being effectively and efficiently utilized.

Recommendation

In addition to relying on governmental assistance, it would behoove farmers to subscribe to agricultural magazines from accredited institutions and to join international and regional farming organizations to avail themselves of advances in the use of technology such as smart phones to access weather predictions. A boon to assisting with this would be for a central website to serve as the hub to disseminate the results of research being conducted locally and within the region to younger up and coming farmers as well as present farmers who utilize the internet. Use of such technology can help farmers decrease cost by using improved seeds which may need less fertilizer or may be more drought tolerant than current seeds used in production.

Farmers also expressed concern about seed availability as well as seed vigor. This may leave an avenue open for local tertiary institutions to conduct studies on the vigor and viability of locally derived seeds. This use of university facilities will be an aide in strengthening crop production value chains in The Bahamas as money can now be invested in seeds that have some level of germination guarantee. This increases production, productivity and ensures that farm equipment will be more efficiently used to their maximum capacity. Also as research and training is increased Bahamian farmers who are already involved in seed saving may be able to gradually move their enterprise from simple pot hole farming to organic seed farming. This however will require meticulous record keeping, a skill that is sorely lacking among Bahamian farmers. As such Extension services can be utilized to show farmers how they can improve their production by

recording historical data and consulting it during decision making.

Test plots are needed to show local farmers how their production can be improved. A stronger relationship needs to be sought with customers to allow farmers to better respond to customer demand. The Bahamas also needs well trained Extension Officers to evaluate and disseminate advancing technology with local farmers.

Future research may also benefit from increasing the sample size by including other islands with packing houses into the discussion to gaining increased insight into the level of technology being used in these islands. Additionally, statistical programs should be utilized to analyze the data garnered.

One area in which improved technology use can be intensified is the production segment of the agricultural value chain where inputs are purchased and utilized. It is at this stage of production that quality assurance should begin. This means that only inputs of the highest quality should be used in the most effective manner to produce a product of superior quality and consistent quantity. Achieving this goal becomes less daunting if the challenge is approached from a value chain perspective. Using this method will help farmers to understand how they can use research and better utilize current technologies to add value to primary products by improving seed selection, fertilizer use, harvest times and irrigation.

Finally, if similar research is conducted in the future it would be beneficial to visit all of the farms in question. This will help to increase the certainty of the information provided as some farmers were not aware of the size of their farm. Visiting in person will also reduce the need to utilize personal telephones to conduct this sort of research. Also in the future, direct questions may better achieve the research object. Questions such as „Do you use the internet to improve your crops? Do have the soil on your farm tested? Do you test the levels of salt and other minerals in the water used on the farm?" should be included in the future. Such questions speak to the need to evaluate such levels being that the equipment to achieve these goals is not expensive and can result in a major decrease in the frequency of fertilizer applications as fertilizer can become bound to ions in the soil and become unavailable to plants.

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Table 1: Technology use rating rationale

Technology Use Ratings		
High Technology Use 11-15 pts.	Medium Technology Use 6-10 pts.	Low Technology Use 1-5 pts.
Heavy reliance on ICT for problem solving and resource acquisition	Some reliance on ICT for problem solving and resource acquisition	No reliance on ICT for problem solving and resource acquisition
Consistent use of current agricultural periodicals	Infrequent use of current agricultural periodicals	No use of current agricultural periodicals, relies solely on personal experience
Meticulous record keeping	Limited record keeping	No record keeping
Relies on university research and Ministry of Agriculture Staff	Relies on university research and Ministry of Agriculture Staff	Little reliance on Ministry of Agriculture Staff and no reliance on university research
Use of drip irrigation only	Use of some drip irrigation and hand watering	Hand watering, no use of drip irrigation

Table 2: Crops currently being grown in the islands

Island	**Crops Grown**

Abaco	Mango, avocado, guava, lime, lemon, sour orange, onion, tomato, sweet pepper, banana, coconut, breadfruit, pomegranate, sugar apple
Andros	Peppers, pumpkin, sweet potato, tomato, green peas, cucumbers, watermelon, thyme, hot pepper, goat pepper, sweet corn, cauliflower, lettuce, onion, okra.
Cat Island	Watermelon, pumpkin, green beans, finger pepper
New Providence	Oranges, lime, pigeon peas, corn, potato, cassava, eddies, tangerine, mango, coconut, avocado, banana, sugarcane, papaya, seagrape, nuts, grapefruit, cabbage, onion, sweet pepper, kale, mint rosemary, bock choy, cilantro, garlic chives, passion fruit, Swiss chard, broccoli, mustard greens, collard green, arugula, scallions, sage, beets

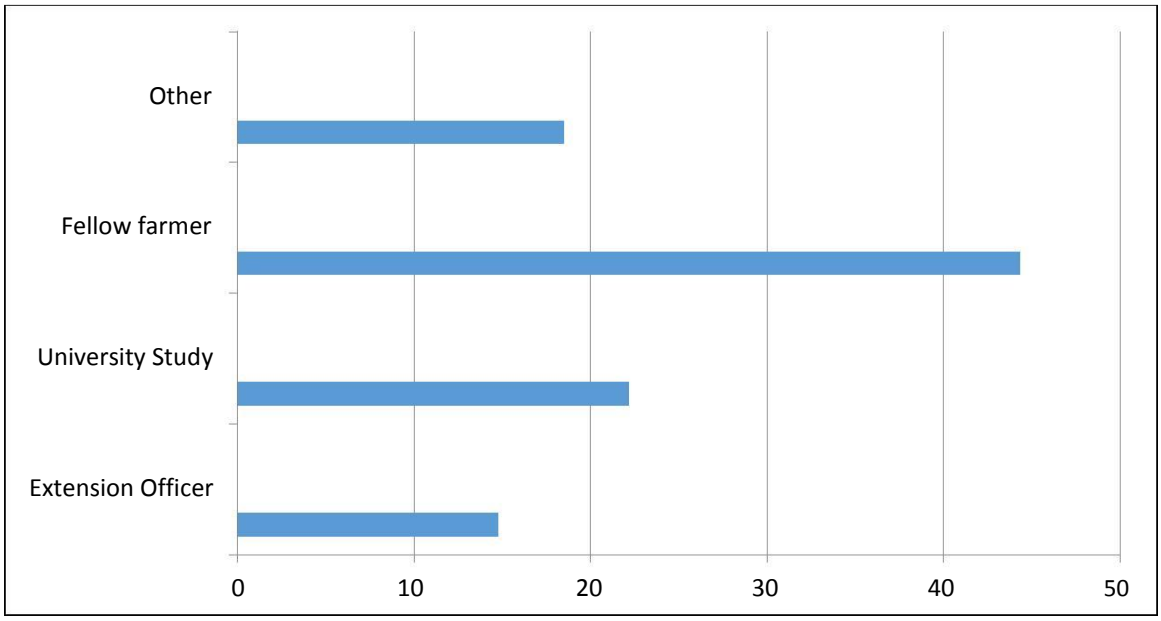

Figure 1: What would convince you most to try a new type of crop production method?

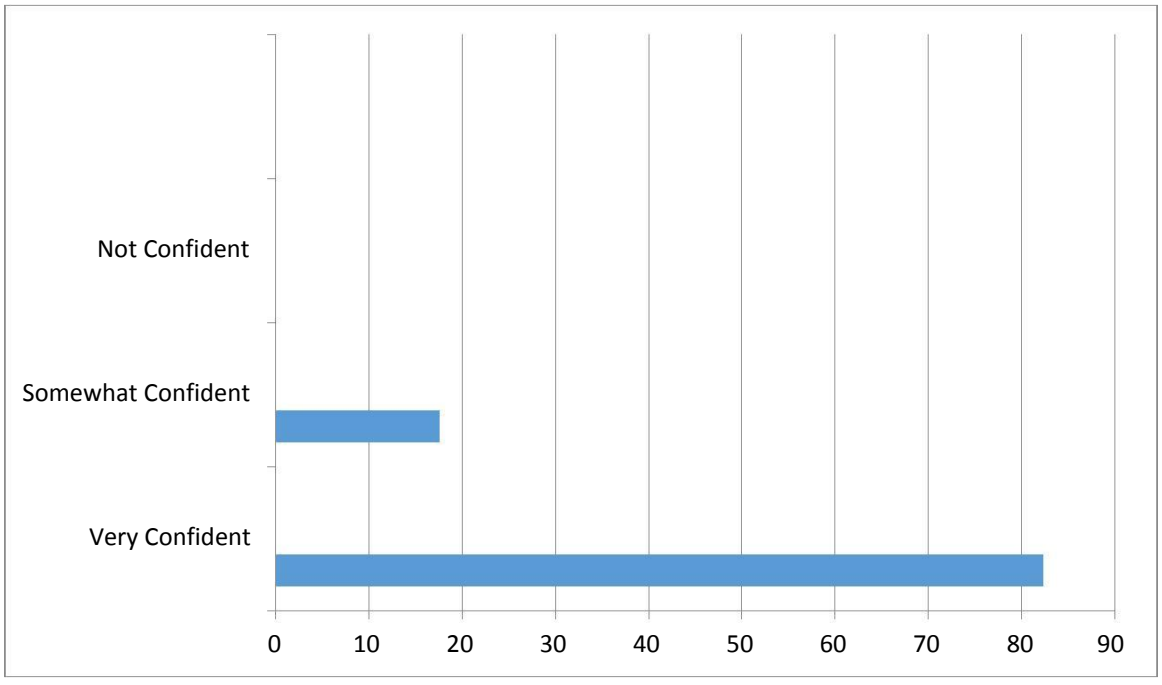

Figure 2: How confident are you that the information provided by the extension officer is (or would be) current?

APPENDIX

Island:_____ Farmer Name:_____

Farmer Number for this study: _____

Please circle the most appropriate answer.

1. What is your age?
   18-20 21-30 31-40 41-50 51-60 +61

2. What is your gender?
   Female Male

3. What is the size of your farm? _____

4. How many acres do you have under cultivation? _____

5. What crops do you currently have under cultivation?

6. Would you be willing to enroll in a course to learn improved farming techniques? Yes No

   For how long?
   Half a day 1 day 2 days 3 days +4 days

7. Are you a subscriber to any current agricultural magazines/periodicals? Yes No

8. What would convince you most to try a new type of crop production method?
   a) If a local extension officer told you about it
   b) A study conducted by an university
   c) If a fellow farmer used it first
   d) Other (personal internet search, watched it on television)

9. Who is the extension officer for the island? _____

10. How confident are you that the information provided by the extension officer is (or would be) current?
    a) Very Confident
    b) Somewhat confident
    c) Not Confident

11. Are you a member of a farming co-op, marketing board or crop authority? Yes No
    If yes, which one? _____

12. Do you think that this organization has been effective in assisting you with new crop production techniques? Yes No

13. How do you determine what crops you will plant?

B) Do you purchase any products directly from overseas?

C) How do you determine when you will harvest crops?

D) How do you determine how you will plant crops? (what to plant next to another, if to plant directly or transplant etc.)

How do you determine how much water and fertilizer each plant will receive?