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An Analysis of a Successful Technology Transfer Program in Andhra Pradesh, India

by Dr. Francis Rao Eddu

Abstract

Many of the early international development projects between the United States and India focused on agriculture. In the 1960s, India was experiencing extreme food shortages due to population growth and drought in several states. The United States offered agricultural expertise that was sorely needed by India to expedite its food/agricultural production. The Agricultural Production Project in Andhra Pradesh State was one of several programs USAID undertook to help transfer agricultural technology, including improved farm implements, to increase food grain production. This part of the project evolved into a successful program that reached thousands of farmers.

Introduction

In the 1960s, USAID, in cooperation with the government of India, supported extensive development programs. The newly independent country was in need of assistance in numerous areas, including production of sufficient food for the growing population and to alleviate the problems caused by recurring drought in several states. Design and development of appropriate technologies and innovations suitable for Indian conditions were paramount. In Andhra Pradesh, a Telugu speaking state in south-central India, Kansas State University (KSU), in conjunction with counterparts in Andhra Pradesh Agricultural University (APAU)(research) and Andhra Pradesh Department of Agriculture (APDE) (extension), fielded a team consisting of specialists in soil fertility, plant protection, irrigation, seed production, and farm implements in an Agricultural Production Project

focused exclusively on food grain production. The Project ran from 1967 through 1971.

The analysis presented herein is centered on one segment of the Project, namely, farm implements, and the activities of Layle Lawrence, the farm implements specialist from KSU. Lawrence worked with personnel from APAU (G. Ramana Reddy, agricultural engineer) and APDE (P. Permju, field assistant), and with manufacturers, farmers, research stations and District extensionists to discover, test, modify, popularize and, in one instance, develop agricultural implements and machines that would increase production.

Lawrence arrived in India in February 1967. His early months were spent in becoming acquainted with agricultural practices and problems by visiting research and extension personnel and farmers in Andhra Pradesh and implements manufacturers throughout India. With USAID funding, Lawrence and Reddy were able to travel throughout the country and purchase implements and machines that appeared to have the potential to increase production beyond that attained locally with traditional methods. They tested the implements for utility and quality and compared field test results with traditional methods and practices. As a result, they were able to put together a "package" of improved bullock-drawn and hand operated implements that, if adopted, could increase food grain production rather dramatically. The implements package included a six-inch and nine-inch steel beam moldboard plow, disk harrow (for seedbed preparation and

for puddling), spike tooth harrow, row crop cultivator, seed-cum-fertilizer drill, land leveler (renamed "bullock dozer"), and assorted hand tools and sprayers. In order to avoid creating social problems by displacing laborers and to be cost-effective for traditional farmers, emphasis was not placed on high-end, expensive machinery such as tractors.

The implements team found that traditional methods of threshing were superior to any mechanized thresher available. However, the team determined that a simple and efficient machine was needed to avoid the loss of 10% or more of the grain that occurred with traditional methods. In addition, to further the practice of multiple-cropping, threshing needed to be done quickly. In this context, Lawrence set out to design a versatile, basic and affordable thresher that could be operated with a five horsepower diesel pumpset engine (which many farmers had); could thresh several different crops (particularly rice, wheat and jowar); would remove all, or nearly all, the grain from the straw; and would not appreciably displace labor. Lawrence decided that one could be developed by closely duplicating the threshing mechanism found in a combine harvester and placing it on a suitable frame. He was encouraged by locating a local concern that could cast the rasp bars needed and another that could supply the required bearings. Finding little interest among larger manufacturers in developing the thresher, Lawrence contacted P. B. Chary, owner of Karshak Industries, located a few blocks from the historic Charminar monument in the center of Hyderabad. With two helpers, Chary was practicing his family's centuries-old voca-

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Successful Technology Transfer Program (Continued)

tion of blacksmithing and was manufacturing a diverse line of small agricultural equipment such as paddy and vegetable weeders, hand hoes, and iron claws. His facility consisted of about 12 by 16 feet of floor space equipped with a homemade arc welder, a drill press, a forge built into the landing in front of the door, and various hand tools. Lawrence offered to fund the material and labor costs of developing a prototype machine with the provision that if the machine was successful, Chary had full rights to manufacture it. Chary readily agreed.

Over a period of several weeks, Lawrence and Chary developed the thresher's framework, struggled to make the cylinder perfectly round, assembled the concave grate, and formed the sheetmetal feeding table and cover. After creating and assembling the necessary parts, they greased the bearings, adjusted the concave clearance, balanced the cylinder to avoid vibration, and applied a coat of bright orange paint. Chary named the machine the LDL All-Crop Thresher. Tests on nearby rice farms were successful beyond expectations. The machine was also tested on wheat, jowar, bajra, ragi, and even maize with satisfactory results. Lawrence prepared and had published an operator's manual. Later a Model II machine was developed, which included a blower, straw racks, and sieve that could separate the grain from the straw and, to some extent, winnow the grain.

Having noted his enthusiasm and abilities, Lawrence provided Chary with models of the moldboard plow and disk harrow to him. Previously these implements had to be ordered from manufacturers in northern India, a major deterrent to their adoption. Chary was able to reproduce and manufacture these as well.

The Extension Approach

To popularize the improved implements and machines, the implements team proposed a series of demonstration teams manned by extension fieldmen who would demonstrate and teach farmers to use the equipment. With funding from USAID, personnel from APDA, and trainers from APAU, twelve fieldmen from various parts of the state were selected and intensively trained in field operation, repair, maintenance, and demonstration procedures, as well as agronomic practices for various

crops. Each team of two fieldmen was provided two sets of implements, a thresher, a sizable supply of spare parts, printed information, a Krishi power tiller (without the tiller), and a trailer for transporting the implements to farmers' fields. The tiller could be used for operating the thresher as well. Teams were instructed to teach the farmer to use improved implements on half of the farmer's field with the farmer using his traditional methods on the remainder. The farmer could observe the results and would (hopefully) purchase and use the improved implements. Raju and Lawrence supervised the demonstration centers for some time to overcome any problems that might occur and to provide support and encouragement to the fieldmen.

After noting some success, a second group of fieldmen was trained and five additional demonstration centers were established. Raju continued to supervise the centers after Lawrence's departure from India in 1971.

Karshak Industries

Shortly after Lawrence's departure, with revenues earned from sales of threshers and other implements, Chary bought land and built a new facility to accommodate and enhance the manufacturing process. Over the succeeding years, the factory has grown to provide the capacity needed for an expanding business. As demand grew, in 1985 Chary opened a showroom in Secunderabad. Chary's two sons manage the workshop and the showroom. Machines have been sent as far away as Israel.

As sole proprietor of the thresher, Chary has been able to manufacture and sell about 200 machines per year. Since there is no comparable product the thresher has been a huge success, especially in the rice producing areas. Farmers from outlying districts have sometimes camped for several days at the factory's premises to become acquainted with the machine's operation and to purchase a thresher for their farm. Less affluent farmers have often pooled resources to purchase the machine and often do additional threshing on a contract basis. When water is available, three crops of rice can be produced per year in

Andhra Pradesh. As a result, a thresher owner can make a considerable profit. About two hectares of rice can be threshed in a day's time.

Based on feedback from farmers and through their own research, Chary's Karshak Industries has improved the thresher. Farmers complained that separating grain from straw was time consuming and required considerable labor. Over time, modifications and improvements have been made in the design of the separation and cleaning mechanisms, straw walker, sieves and fan, thereby reducing time and labor requirements.

Karshak Industries has received numerous state and federal awards for machine design and for disseminating innovative agricultural practices to generate food production and employment. In recent years, the state government's agency, Andhra Pradesh Agricultural Commission, has recognized the thresher's value and has provided subsidies to farmers who purchase them.

Epilogue

Development of innovations for traditional farmers in developing countries requires a different set of efforts in assessing, designing and implementing strategies to meet their unique economic, social and cultural requirements. In this case, the technology-driven agricultural know-how of an American specialist has enabled a small Indian manufacturer to provide appropriate technology and to encourage Indian farmers to adopt and use the technology. This resulted in increased food production for the nation. Contrary to popular belief, appropriate design and technology transfer strategies can sustain development projects even after the withdrawal of experts from the West.

Dr. Eddu is Program Manager of an NGO in India and is involved in action research, adaptive trials and extension. This article is based upon interviews and correspondence with Dr. Layle Lawrence, Professor Emeritus at West Virginia University, and Mr. P.B. Chary, owner and manager of Karshak Industries, located in Hydembad, AP, India.

WVU Extension Service's 2005 Individual Program Excellence Award Autumn Olive Control Program

by Bruce M. Loyd, WVU Extension Service, Lewis County

Bruce Loyd has been recognized by the WVU Extension Service for Individual Program Excellence in 2005 for an Autumn Olive Control Program. This was a comprehensive program that combined research and teaching.

Autumn Olive (*Elaeagnus umbellata*) is a spreading, upright, shrub that was introduced to the United States from eastern Asia for use in conservation plantings. It is listed as a noxious weed in 23 north central and western West Virginia counties. Many farmers consider autumn olive to be a severe brush problem. It spreads easily and can take over pastures or idle fields, removing many acres from active grass production. Mechanical control, such as brush hogging, mowing, or grubbing, is not a feasible long term option due to the ability of this plant to resprout easily. There are no herbicides labeled for autumn olive control in pasture. The objective of this project was to find a practical, cost effective control measure for this severe pasture brush problem.

Foliar herbicide applications can be effective to control autumn olive, but these applications can be very difficult, depending on terrain, brush size, and plant density. Basal stem applications, where the stem is sprayed from ground level to a height of about 15 inches, have a number of advantages. These include greater flexibility in timing of applications, the ability to target plants when brush is mixed with non-target plants, safety, ease of application, and fewer equipment requirements. Field trials were conducted in 2002-2004 in Lewis County, to determine the effectiveness of basally applying 4%

Crossbow (triclopyr + 2,4-D) or 20% Remedy (triclopyr) using No. 2 diesel oil as a carrier, to control autumn olive plants of varying sizes. Applications were done in October, February, March, and May. Excellent (>95%) brush control was observed following application of either herbicide treatment.

Continuing work in this area included two more research projects in 2005. The objective of the first, conducted in March 2005, was to determine if lower rates of herbicide would control autumn olive using the basal bark application method. Lower rates would lower costs, which is part of the original objective. Preliminary results indicate that lower rates of Remedy will be effective and will lower control costs by 93%.

The second project, conducted in May 2005, was to determine the best control using a foliar application method (spraying leaves during the growing season). This is an application method that more people have used and are familiar with. Six different herbicides and three tank mixes, for a total of nine treatments, were applied to mixed brush, which included autumn olive, multiflora rose, and tartarian honeysuckle. Results indicate that none of the foliar treatments will be as consistent as the basal stem treatments in controlling autumn olive, although more work is needed in this area.

Beginning early in 2005 and continuing through the fall, the results of the research were presented at seven different programs in Harrison, Doddridge, Braxton, Upshur, Barbour, and Lewis Counties. In addition it was presented to the West Fork Conservation District, the WV Grasslands



Dr. Lawrence S. Cote, Associate Provost and Director, WVU Cooperative Extension Service with Bruce Loyd

Steering Committee, and the WV Invasive Species Working Group. The presentation is also part of the 2005 Statewide Private Pesticide Recertification Program. In addition, Bruce was on the program of the West Fork Agriculture Field Day held in May 2005 in Harrison County, where he presented results of the research, as well as other pasture weed control information.

The basal bark application method has been adopted and used by 23 farmers in the central West Virginia area to control autumn olive (The number given is those that are known – it is estimated that at least twice that number have used the basal bark application method following the programs).

The research was presented as a poster presentation at the National Association of County Agricultural Agents annual meeting and professional improvement conference in July 2005 in Buffalo, NY, where it was the National Winner in the research division.

We, the Agricultural and Environmental Education faculty and staff, wish you and your family a happy holiday and very prosperous new year.

WVU Extension Service's 2005 New Employee Excellence Award

Georgette Plaucher, WVU Extension Service, Tucker County

West Virginia University Extension Service honored Georgette Plaucher, WVU Tucker County Agriculture Extension agent and instructor, with the New Employee Excellence Award and recognized her work with the statewide Dining with Diabetes team. The new employee award honors successful individuals who have worked with the Extension Service for three years or less and have made significant strides toward excellence.

Plaucher has worked extensively with agriculture and natural resource projects, including organizing and operating the local farmers' market since 2003. She serves as assistant barn chairman during the Tucker County Fair and helps with the open and 4-H exhibits. Plaucher is also coordinator for both the Randolph-Tucker Master Gardeners and the annual Tucker County Progressive Farmer® Rural Safety Day Camp.

Since she began her career in Extension in 2004, Plaucher has held a pasture walk, a series of three farm management sessions, organized a Master Gardener certification class, and conducted a farmers needs assessment. She also provides information to her clients via on site visits, in office consultations, three quarterly newsletters (CEOS, 4-H, and Agriculture and Natural Resources), and a monthly column in the local newspaper. She answers questions from "what insect is this" to "how do you wash a cat".

Her outreach in Tucker County also encompasses 4-H youth development, where she works closely with the Tucker County 4-H Leaders Association and local 4-H members. Each year she assists with planning and operating 4-H horse camp and traditional 4-H camp. Throughout the year, Plaucher coaches three 4-H judging teams, horse, livestock, and forestry.

Family and consumer science programs are another component of Plaucher's job. The programs include the Community Educational Outreach Service (formerly Homemakers), whom she works closely with to plan educational programs and community service projects. Additional community educational programs coordinated by Plaucher and conducted through the Tucker County Extension Office include Energy Express, Germ City, and Dining with Diabetes.

Serving on numerous boards and as a member of many county and state organizations helps Plaucher promote community development. She is a member of the Tucker County Fair Association, Tucker County Farm Bureau, West Virginia Forestry Association, and the West Virginia Cattleman's Association. As a member of these organizations, she occasionally provides advice and guidance.

As Vice President of the Tucker County Planning Commission she is cur-

r e n t l y helping the group revise the county comprehensive plan. The group also researches projects and issues in the county and reports their findings to the county commission.



Each year, Plaucher attends numerous conferences and meetings to continue her education. She takes much of the knowledge she gains and teaches a wide variety of topics throughout the county which include horticulture and gardening, agriculture, forestry, health and wellness, and arts and crafts.

Plaucher enjoys her work as an Extension agent because the job offers the opportunity to be creative. Each day in Extension presents new discoveries that either answer questions or ask new ones. It isn't the awards that make her feel a sense of accomplishment, but the smiling faces on the 4-H'ers and the "thank you's" from her clients.

Editor's Comments: Change Agents

by Harry N. Boone, Jr.

It is not necessary to change. Survival is not mandatory. W. Edwards Deming

As agricultural educators and Extension agents we never fully understand the influence we have on our students/clients. Occasionally we have the rare opportunity to view the influences we had in a specific situation. In the lead article, Dr. Layle Lawrence has the opportunity to view the lasting influence his educational efforts in India had on the residents of Andhra Pradesh. His efforts brought about a lasting change to the economy and individuals of the region. He can take great pride in his accomplishments.

Speaking of change, the Agricultural and Environmental Education Department is currently in the process of changing its name to Agricultural and Extension Education. Major changes in the makeup of the department over the past five to ten years resulted in a change in the mission of the department. With the retirement/departure of the agricultural engineers on the faculty and the employment of a full-time faculty member with Extension experience, the focus of the department underwent a major change.

The Division of Resource Management recently received approval to change the name of its doctoral program

to Resource Management and Sustainable Development. Within the program four options will be available; Natural Resource Economics, Resource Management, Agricultural and Extension Education, and Human and Community Development. The bottom line is that students can earn a Doctor of Philosophy at West Virginia University in Resource Management and Sustainable Development with an area of emphasis in Agricultural and Extension Education.

The opinions expressed are those of the editor and do not necessarily represent official positions and/or opinions of the Agricultural and Environmental Education program, the Davis College of Agriculture, Forestry, and Consumer Sciences, or West Virginia University.

WVU Extension Service's 2005 New Program Excellence Award

West Virginia Industrial Home for Youth Master Gardener Project

by Larry G. Campbell, WVU Extension Service, Harrison County

West Virginia Industrial Home for Youth (WVIHY) Master Gardener Project is a horticulture training program conducted for youth incarcerated in the WV Industrial Home for Youth maximum security prison. The WVIHY project was begun in 2004 as a vision of Larry G. Campbell, WVU/Harrison County Extension agent, and a local Harrison County Master Gardener.

Participants in the program are youth who have completed their high school education and who meet the prison behavioral requirements. The goals of the program are both vocational and therapeutic in nature. Participants are taught horticultural skills which will help them to obtain employment in the landscape industry. In addition the WVIHY substance abuse counselors are able to use the program's non-chemical approach to healthy plant growth as a model for healthy lifestyles in their substance abuse therapy with the inmate participants who are drug abuse offenders. The program utilizes Master Gardener training materials which are adapted to a basic eighth grade reading level. The concepts from the Master Gardener training materials are presented in a hands-on format as much as possible. The program covers topics such as soils and fertilization, composting, botany, landscape design, turfgrass management, plant propagation, vegetable gardening and equipment, tree fruit, small fruit, entomology, plant diseases, herbaceous plants, and woody ornamentals.

The instruction is presented in both a classroom and an in-the-field format. Weekly instruction is presented primarily

by Agent Campbell and a Master Gardener volunteer. Guest Extension faculty are used as instructors for two of the classes. Two unique instructional activities are the vegetable garden and the landscaping projects. A vegetable garden was developed onsite to give the inmates practical experience in planning and developing a garden, site preparation and cultivation, planting seeds and plants, maintaining a garden, and harvesting and sharing the produce. In 2005 inmates were taught to plant corn, squash, and pole beans together utilizing a Native American method known as the "Three Sisters". The landscaping project taught inmates both landscape design skills and provided them experience in working with ornamentals.

As a result of the program the past two years, 19 male and four female inmate youths developed basic horticultural skills which prepared them for potential future employment in the gardening industry and enhanced their personal resumes. The program produced an effective collaboration between the WVU/Harrison County Extension Office and the WVIHY staff to serve a needy and underserved population.

The program also provided the WVIHY counseling staff a unique opportunity to provide therapy to the youth outside the confines of the traditional program setting. One WVIHY therapist summed up the impact of the program by stating, "Youth were able to learn teamwork and trust with a common goal. The project fostered clean and sober leisure activity for youth with severe addictions issues." Several of the youth expressed a

desire to study horticulture further and at least one of participants has the potential and desire to pursue horticulture on the collegiate level.



All participants took great pride in both the vegetable garden and the landscaping projects. Produce from the vegetable garden was shared with fellow inmates and the Clarksburg Mission. The significance of this component was well stated by another WVIHY therapist who said, "The vegetable garden helped promote community service, as vegetables were given to the Clarksburg Mission; thus creating such wonderful feelings of pride and self-esteem." The program also helped the inmates connect with positive memories of their families from whom they are separated. While working the garden, many of the youth talked about "grandma's garden", their mothers' favorite flowers, or "dad's big tomatoes."

The warden at the WVIHY expressed great satisfaction regarding the results of the landscaping project which transformed an unattractive and neglected site into an attractive and well designed landscape planting. The wholehearted and enthusiastic support given by the warden to the program speaks volumes regarding its impact and value.

WVU Extension Service Award Winners

New Employee Excellence

Georgette Plaughter, Brandon Takacs & Brian Wickline
Bruce Loyd

Individual Program Excellence - Autumn Olive Control

Team Program Excellence - Economic Analysis of Marketing Weaned Calves

Larry Campbell, Debra Friend,
Ronnie Helmondollar, Bruce Loyd, & Gary Rapping

Team Program Excellence - Dining with Diabetes

Andrea Bennett, Guen Brown, Linda Dameron, Kay Davis, Billie Frye,
Martha Garton, Michael Hall, Sally Howard, Louanne Huff, Robert Knight,
Miriam Leatherman, Barbara Loudin, Mindy Mall, Judy Matlick,
Diane Meadows, Margaret Miltenberger, Lisa Mitchell, Stephanie Moore,
Patty Morrison, Karen Newton, Leone Ohnoutka, Georgette Plaughter,
Charlie Rickman, Sue Riggs, Deborah Shriver, Sally Summers,
Gloria Wagner, Linda Waybright, Shirley Wilkins, & Barbara Wolfe

Research Summary: Knowledge and Dissemination of Sustainable Agriculture Practices by County Extension Agents in Ohio, Pennsylvania, and West Virginia

by E. M. Hersman, H. N. Boone, S. A. Gartin, D. A. Boone, & T. McConnell

Agriculture continues to experience a crisis that includes, in addition to rapid financial and structural changes, an awareness of farming's enormous influence on ecosystem health (National Research Council, 1989). When determining the level of environmental stewardship necessary to maintain an ecologically sound farmland system, sustainable agriculture comes into play. The National Research Council (1993) argues that sustainability is necessary to "keep the productive capacity of natural resources in step with population growth and economic demands while protecting and, where necessary, restoring environmental quality" (p. 66). Sustainable agriculture refers to an agricultural production and distribution system that: 1) Achieves the integration of natural biological cycle and controls; 2) Protects and renews soil fertility and the natural resource base; 3) Optimizes the management and use of on-farm resources; 4) Reduces the use of nonrenewable resources and purchased production inputs; 5) Provides adequate and dependable farm income; 6) Promotes opportunity in family farming and farm communities; and 7) Minimizes adverse impacts on health, safety, wildlife, water quality, and the environment (Sustainable Agriculture Network, 2002, p.1).

Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs (Feenstra, 1997). In other words, sustainable agriculture challenges educators and farmers to think about the long-term implications of practices and the broad interactions and dynamics of agricultural systems. This is to be accomplished while balancing profitability, stewardship of natural resources, and the health of the rural community. Sustainable agriculture practices will eventually lead to the successful management and improvement of ecologically sound farmlands.

There are many ways to improve the sustainability of a given farming system and these vary from region to region. However, there are some common sets of practices among farmers trying to take a more sustainable approach, in part through greater use of on-farm and local resources (Sus-

tainable Agricultural Network, 2002). For example, in order for farmers that practice sustainable agriculture to be successful in managing their farmlands, there must be a continuous network of information, new technologies, and innovations that are available to them. Educators must remain current on the latest agricultural research and technology, enabling them to understand the needs and problems that their clientele are facing.

The Extension Service can play a crucial role in providing this network of information on sustainable agriculture education. Extension not only has a long history of service to farmers but Extension agents have also gained their respect and trust (Warner & Christenson, 1984; McDowell, 1992). The role that Extension should occupy in promoting sustainable agriculture is spelled out in the 1990 Farm Bill. The Farm Bill states that Extension agents must be trained in sustainable agriculture in order to "develop their understanding, competence, and ability to teach and communicate the concepts" to farmers and others (Agunga, 1995, p. 172). The Extension Service, due to its large network of personnel, is in position to formulate a cohesive structure for promoting sustainable agriculture education, however, if extension agents are not convinced of the value of sustainability, how can they expect to educate farmers on the concepts (Agunga, 1995). Because the Extension Service must play a critical role in the involvement of sustainable agriculture education, it is vital to understand the preparation levels that Extension educators have regarding the relatively new concepts involved with sustainable agriculture. Extension educators' knowledge about the concept of sustainability is necessary in order to move the program forward (Minarovic & Mueller, 2000). A necessity in the progression of sustainability programming is that Extension educators present and disseminate sustainable agriculture knowledge information that they acquire.

Research Design

A descriptive survey research method was used to collect data from the target population. "Descriptive surveys focus on

determining the status of a defined population with respect to certain variables. They basically inquire into the status quo; they attempt to measure what exists without questioning why it exists" (Ary, Jacobs, & Razavieh, 1990, p. 407). The target population for this study was 179 Agriculture and Natural Resource Extension Agents employed in Ohio, Pennsylvania, and West Virginia. Out of the total 179 questionnaires administered, 126 were returned. Of those returned, 121 (67.5%) were usable.

A questionnaire was mailed to the 179 Agriculture and Natural Resource Extension Agents in Ohio, Pennsylvania, and West Virginia. The survey instrument was developed by the researcher based on the review of literature. Faculty members in Agricultural and Environmental Education and the West Virginia University Extension Service examined the survey to establish content and face validity. Instrument reliability was determined from an analysis of the data using the split-half statistical procedure. A correlation of .48 was found between the two forms representing an "exemplary" reliability (Robinson, Shaver, and Wrightsman, 1991).

Findings

Sustainable Agriculture: Understanding and Research Availability. In general, the Extension agents believed that sustainable agriculture was profitable (79.3%), productive (75.2%), small-scale (82.7%), environmentally sound (89.2%), and with low chemical input (80.0%). In terms of organic farming, there was a more even distribution between respondents that agreed (58.3%) that organic farming constituted sustainability and respondents that disagreed (41.7%) that organic farming constituted sustainability. The Extension agents that were surveyed did not believe that sustainable agriculture was non-animal related (87.5%); they believed it was a priority for present clientele interactions (87.7%), and they considered it a priority for future clientele interactions (90.9%).

In terms of perception of availability of research findings, Extension agents that were surveyed agreed that if farmers were provided information on sustainable agriculture, it would increase the likelihood

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Knowledge and Dissemination of Sustainable Agriculture Practices (Continued)

they would adopt the concepts (83.9%); there was scientific proof that sustainable agriculture was environmentally sound (77.3%); there was scientific proof that sustainable agriculture was economically feasible (68.1%); there was scientific proof that sustainable agriculture was socially acceptable (80.5%); research on sustainable agriculture was still in its infancy (73.6%); and if researchers made innovations available on sustainable agriculture, they would communicate the information to farmers (98.3%). Extension agents that were surveyed disagreed that they did not know where to get information on sustainable agriculture (85.7%) and disagreed that they did not know enough about sustainable agriculture to inform others (74.7%).

Extension Educators' Participation in Sustainable Agriculture Professional Development. The majority of the respondents attended workshops (81.8%) and conferences (74.4%) on the central concepts of sustainable agriculture. There were fewer respondents (23.1%) that attended dinner meetings or other (25.8%) professional development events dealing with the central concepts of sustainable agriculture. The majority of the respondents that attended professional development events perceived them as dealing more with the economic viability (80.0%) and environmental soundness (77.3%) aspects of sustainable agriculture as opposed to the social acceptability aspect (39.2%).

Extension Educators' Use of Information and Skills Gained from Professional Development. The majority of the respondents' education on sustainable agriculture has sustainable implications (76.0%). Some respondents indicated that their education on sustainable used sustainable examples (12.4%), and 7.4% of the respondents indicated that their education on agricultural practices was in direct conflict with their perception of sustainable agriculture. The audience that participated in workshops and/or meetings on sustainable agriculture were mostly farmers (88.1%), part-time agriculturalists (63.1%), the public (44.0%), and other agents (44.0%).

The majority of the respondents (53.3%) indicated that the concepts of sustainable agriculture were addressed, although not the major topic, in workshops and/or meetings that they had conducted.

Thirty-five percent of the respondents indicated that the concepts of sustainable agriculture were the subject of at least one workshop and/or meetings that they have conducted and 11.7% of the respondents indicated that the concepts of sustainable agriculture were never addressed in workshops or meeting that they had conducted.

For the Extension agents that responded to the survey, 23.1% developed fact sheets or publications based on the concepts of sustainable agriculture, and 51.0% of the respondents used fact sheets or publications on the concepts of sustainable agriculture in their educational activities. The majority of the respondents (27.3%) perceived less than 5% of full-time agriculturalists apply sustainable agriculture concepts, and 19.1% of respondents for each of the categories 6-15% and 16-30% perceived full-time agriculturalists apply sustainable concepts.

Respondents were asked their perception of the number of part-time agriculturalists in their county/community that apply the concepts of sustainable agriculture. It was concluded that a majority of the respondents perceived less than 30% of the part-time agriculturalists apply sustainable agriculture concepts and 21.8% of respondents perceived 31-45% of part-time agriculturalists apply the concepts of sustainable agriculture.

Areas of Sustainable Agriculture that Extension Agents Desire Training. Extension agents that responded to the survey were interested in training on the following topics: integrated insect pest management (85.0%), sustainable agriculture farm management practices (89.4%), natural resource conservation (78.7%), organic matter management (83.1%), water quality with respect to agrichemicals (79.0%), innovative farming systems (94.7%), crop rotations (77.9%), food safety and pesticide residues (75.0%), recycling farm waste (84.0%), economics of sustainable agriculture (91.2%), educational communication/Extension in sustainable agriculture (81.0%), restoration of the family farm (68.4%), system theory including biological systems (59.6%), marketing of sustainable agricultural products (86.1%), composting (73.1%), grazing/forage management (79.7%), and grass fed livestock (71.1%).

Conclusions

Based upon the findings of the study, the following conclusions were reached:

Part-time agriculturalists were perceived to attend workshops/meetings based on sustainable agriculture practices, use fact sheets or publications on the concepts of sustainable agriculture, and, in turn, apply concepts of sustainable agriculture.

Full-time agriculturalists attended the workshops and/or meetings and received the fact sheets and/or publications based on the concepts of sustainable agriculture, but were not perceived by Extension agents in their county to be participating in as many sustainable practices as part-time agriculturalists.

Extension agents need to continue to present workshops/meetings that focus on direct sustainable agriculture concepts and incorporate more sustainable agriculture examples. Extension agents also need to "follow-up" on sustainable agriculture workshop participants to ensure that their audience understands the concepts of sustainable agriculture and are putting these concepts to practice.

Social acceptability and the link between community and agriculture needs to be more heavily incorporated into sustainable agriculture concepts and practices.

Extension agents need to distinguish between the terms "organic" and "sustainable" and realize that they do not share the same definition.

Extension agents have expressed a need for training in sustainable agriculture in areas such as innovative farming systems, economics of sustainable agriculture, and sustainable agriculture farm management practices.

Whether accepting or not accepting of the term "sustainable agriculture" Extension agents need to become knowledgeable on the concepts and practices of sustainable agriculture in order to assist their farmers in utilizing the most up to date research in this area.

Erin Hersman earned a Master of Science (2004) degrees in agricultural education from West Virginia University. The complete thesis may be obtained at <https://eidr.wvu.edu/etd/documentdata.eTD?documentid=3398>.

Important Dates

Jan 27-29	FFA Winter Leadership Conference	Cedar Lakes
Feb 1-5	National Agricultural Education Inservice	Indianapolis, IN
Mar 11-13	State Ham, Bacon, & Egg Show	Charleston
April 7	Beef Expo and Grasslands CDEs (tentative)	Jackson's Mill
Apr 27	West Virginia Envirothon	Jackson's Mill

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