Sustainable Agriculture Programs at Auburn University, 2009 and 2010

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Program 1.Organic Integrated Pest Management Initiative to Assist Sustainable Farmers

Grower needs assessments completed in Alabama: Commercial vegetable production in Alabama is worth over $17 to 20 million with production acres exceeding 6,000 acres total. Majority of the produce is for the fresh market and consumed locally. Organic farming for crop and livestock production has much lower acreage and consists primarily of small producers with 5-6 acres per farm. Alabama is a region of high insect pest infestation due to the hot and humid climate of the south; many counties near the Florida Panhandle and the Gulf Coast regions have continuous insect activity resulting crop devastation in summer as well as fall crops. Much of the survey information about vegetable production practices referred to in this document have been collected via surveys conducted by ACES Commercial Horticulture and Home Grounds Teams from 2009-2011. Since vegetables have zero or low tolerance for insect infestation, insect pests remain the major problem in vegetable production and most low resource farmers (LRFs) in Alabama are facing increasing problems with pest management. Due to the cost of conventional pesticide and use restrictions, small farmers that sell directly to consumers are organic and naturally grown farms in Alabama.

Due to the critical nature for Integrated Pest Management (IPM) information, a pilot scale organic program aimed at educating producers about pest management was initiated in 2010 and expanded with multi-institutional partners (Auburn University & Tuskegee University) in 2011. In order to develop an effective IPM campaign that catered to various regions of the State, the ACES Commercial Horticulture TEAM members conducted IPM 'needs assessment surveys' statewide to document the needs from vegetable producers that attended Regional Extension meetings. Results (n = 59; survey return rate = 49%) suggested the IPM adoption rate is about 40% or below with minimal use of insecticides and absence of crop scouting in a timely manner (only 10% growers used pheromone-based insect traps). Lack of awareness of IPM programs and difficulty in accessing information were two of the major barriers to the low adoption rate of IPM tactics. About 35% respondents desired IPM training through a variety of learning approaches such as hands-on field training, publications, and workshops that are currently being done to improve the situation. Although Internet penetration level was 76% among survey participants, only 20% respondents used the Internet as an educational tool for active learning. Motivated by these survey findings, the Alabama Cooperative Extension System Commercial Horticulture Team reacted to urgent pest reduction needs of organic and naturally grown vegetable producers in the State.

Program 2.Organic No-till Management in Small Scale Vegetables

Project objectives: This is a SARE-funded initiative lead by Drs. Jan Garrett and Joseph Kloepper through grant LS09-218. Project objectives are:

1. Establish a collaborative effort between farmers and researchers to identify NT production methods that are appropriate for a variety of crops, soil types, and farming scales suitable for organic vegetable production in the Deep South.
2. Evaluate the effectiveness of various high residue cover crops and mixtures for ease of growth, maintenance of soil fertility, and weed control.
3. Evaluate tillage treatments across various soil types, cash crops, and cover crops, with respect to soil fertility, weed control, crop yield, and farmer acceptance.
4. Evaluate the effects of different pre-plant fertilizer rates on crop yield, weed populations, and cover crop growth.
5. Expand NT production practices in AL by assisting small-scale farmers in the state with the implementation of organic NT practices.

Program 3. Yellowmargined Leaf Beetle Management in Alabama
The yellowmargined leaf beetle (YLB) is a serious defoliator of cruciferous crops in many southern states, especially in organic vegetable production systems. There are no insecticides available for organic producers to counter the increasing menace of YLB.

Inputs

Program 1. Inputs or participants in Organic Insect Management Program : Over the past two years, vegetable IPM educational projects have been funded by grants from USDA-NIFA, The Alabama Department of Agriculture & Industries, and industry funds exceeding $50,000 that were used over two years with great success (see impacts below). The funds were used to initiate large bioinsecticide demonstration plots at two Research & Extension Centers and to support small demonstration plots in various regions of Alabama. An extensive insect monitoring project that actively trained small producers in insect detection and season-long monitoring was also completed (2009 & 2010). Eight Regional Extension Agents (REAs) from the Commercial Horticulture and Home Grounds Teams participated in insect monitoring project and organized several regional vegetable production meetings for information dissemination to producers. The Team members on this project also participated in farm exhibitions to raise awareness for the project.

Program 3. Yellowmargined Leaf Beetle Management in Alabama. Laboratory studies were conducted to evaluate the pathogenicity of fungal formulations like **Mycotrol O** *(Beauveria bassiana)* and Tick Ex *(Metarhizium anisopliae* strain F52*)*, for supporting the future development of a bio-based management system for YLB. In field studies (2007), the research team evaluated effectiveness of PyGanic (2 pt/A), Entrust (2 oz/A), Pyganic + Aza-Direct (1 pt/A each tankmix), Aza-Direct (2 pt/A), Mycotrol O (1 quart/A), and row covers.

Outputs

Program 1 - Organic Insect Management Program:
The IPM project has served as a model program for revitalizing the organic movement in Alabama with focus on train-the-trainer activities. Results from the 2011 field demonstrations for trap cropping and net house vegetable production will be provided in future reports. In 2099 and 2010, several Regional Extension Agents and Key Farmers have received IPM training for sustainable farming. In the insect monitoring project, commercial farms in 13 counties were monitored for several insect pests using pheromone traps. Information generated was transmitted weekly to farmers via the ALABAMA IPM COMMUNICATOR e-newsletter (600 subscribers with 185% increase in two years), and content on Facebook (54 subscribers), SlideShare (23 presentations) and YouTube (7 IPM training videos). In 2010, IPM information was disseminated to about 530 vegetable producers via 14 face to face meeting (total training time = 445 min) and 3 exhibitions. IPM updates were also provided to the Extension Agents & variety of clientele including industry via four workshops and IPM Web conferences. Information on peach production is available on the Internet. Extension evaluation surveys were conducted at every Extension events for monitoring program quality. Trap crop demonstration plots have been established and one workshop has been completed for farmers. Cucurbit downy mildew sentinel plots were established in four counties in Alabama in 2010. Cucurbit Yellow Vine Decline (CYVD) was detected in Alabama for the first time in 2010. The ipmPIPE web sites, field days and Extension bulletins/newsletters were utilized for information dissemination to clientele.
Activities: In 2009 and 2010, eight REAs participated in on-farm demonstration project on pheromone-based trapping and crop scouting systems that involved training the cooperating

producer. In 2009 and 2010, over 24,000 insects were collected and identified with information directly transmitted to the needy producers via electronic and social media. The REAs also organized several well-attended regional (multi-county) Extension meetings where large and small scale vegetable producers were trained hands-on in IPM techniques and meeting quality was constantly evaluated throughout the year. Extension meetings (about 5-6 per year) were modified with audience input each year resulting in increasing quality of the training sessions over the past two years. Besides Extension meetings with producers, IPM information was disseminated via Extension bulletins, 'THE ALABAMA IPM COMMUNICATOR' newsletter (18 issues per year) with nearly 600 subscribers at present (archived at www.aces.edu/go/128), one vegetable entomology project website (visit www.aces.edu/go/87), YouTube channel with pest scouting videos ('IPM News', visit http://www.youtube.com/user/IPMNews), and Facebook channel ('Alabama Vegetable IPM' on www.Facebook.com) with 54 subscribers. E-newsletter subscribers include 60% farmers, 15% crop advisors, 10% industry personnel, and 15% Master Gardeners. In 2010, about 22 authors contributed over 200 articles to IPM newsletter. Dr. Majumdar is also a contributing author to the Southeastern U.S. Vegetable Crop Handbook published by Vance Publishing (online at http://www.thegrower.com/south-east-vegetable-guide) and thousands of copies of the book are provided each year to the needy producers free of charge. The authors of this report provide hands-on training to the crop producers in insect identification and management using this Handbook. The Home Garden Vegetable Production IPM Guide has also been updated by Dr. Majumdar after a gap of three years due to a high demand from Master Gardeners, home owners, and small producers for a reliable source of information about general use pesticides. Results of the insect monitoring program have also been published in two articles in the Vegetable Grower magazine and four newspaper articles that have reached to over 200,000 readers (multi-state audience). Extension Agents and Specialists have also been trained in Vegetable IPM via the annual IPM Web Conference organized in April every year which is a unique statewide virtual conference. Dr. Majumdar has also participated in six major farm exhibitions (2009-2010) where he has interacted with large number of farmers.

Program 2 – Organic No-till Management in Small Scale Vegetables
Results of First Year of Farm Trials

Farm 1:
Plan: To establish a good summer cover crop and follow it with fall-planted garlic.
Results: The farmer did not get a good enough summer cover crop to control weeds and produce mulch for the subsequent cash crop. Due to summer drought, the foxtail millet did not grow well, but the sunnhemp did much better. Unfortunately, only a small amount of sunnhemp had been planted. Due to failure of the summer cover crop, the farmer will need to start over and till to establish the garlic, and then plans to mulch with wood chips to control weeds.

Farm 2:
Plan: This farmer planted a fall cover crop of Austrian winter pea last fall, flail mowed it, and then planted lettuce and early spring brassicas into the residue.
Results: The Austrian winter pea did not grow back and present a problem to the establishment and growth of the subsequent cash crop, but it decomposed rapidly and did not prevent the growth of summer weeds. Iron clay pea was planted in late summer and following winter kill, brassicas and lettuce would be planted here again. In a larger area of the farm, covering about 3 acres, this farmer had planted a fall cover crop of black oat and lupine. It was rolled and crimped and squash and cantaloupe seedlings were transplanted into the residue. This system worked well due to the large amount of residue produced by the fall cover crop. The farmer reported a good success overall with low amounts of weeds and high transplant survival. The mulched area of the field had a consistently lower temperature and higher moisture content than the non-mulched

area. Picking was much more pleasant and the harvest trucks could be driven into the field even when wet. There was less dust and it was easier to walk on the mulch than on the bare soil.

Farm 3:
Plan: Plant Austrian winter pea in the fall, roll it in the spring, and plant corn into the residue.
Results: The Austrian winter cover crop failed due to very cold weather and it was in a low-lying area that stayed too wet this winter. It was decided to move the project to a higher field. The new field was tilled and planted to iron and clay peas. Due to drought and deer, it was a mediocre summer cover crop, but there was enough weed control to sow a winter cover crop of rye and hairy vetch into the standing peas and let them winter kill or mow over the seed to cover it. This field is set up now to the point where NT could succeed if care is taken to keep the soil covered with either a cover crop or a crop.

Farm 4:
Plan: This farmer started with a field of Bermuda grass, which was tilled and planted to Austrian winter pea in the fall. The objective was to try to get a good cover crop stand that would produce enough mulch to suppress the grass.
Results: The Austrian winter pea did not grow well due to very cold winter temperatures. So, the farmer started over and tilled the whole field in the spring and planted corn and buckwheat. Due to the drought, neither summer crop produced enough biomass to suppress the Bermuda grass and it grew back. Pigeon pea was also overseeded into the corn, but it failed. At the end of the summer, the field was full of Bermuda grass. The farmer overseeded oats into the grass, but at the time of the farm visit in October, none of it was visible in the grass cover. This farmer needs to get an alternative crop established in the field to suppress the Bermuda grass before practicing NT.

Farm 5:
Plan: This farm started the NT project in the spring by tilling a field of grass and planting summer peas. Brassicas, such as broccoli, Brussels sprouts, and cabbage would be planted into the standing peas.
Results: The peas were irrigated and produced a good stand. Brassicas were planted between the rows of peas. The pea plants were laid over out of the way of the brassica seedlings. The plan was to try to harvest some peas before frost killed them. The peas frost-killed and the brassicas are growing well. This field is set up to continue NT if the field is kept continuously covered with a cover crop or cash crop to prevent grass from invading.

Program 3. Yellowmargined Leaf Beetle Management in Alabama. Here are some research highlights from insect behavior and microbial control studies conducted in Alabama.

- At the high field rate (1 x 10^{13} conidia/A), exposure to Tick Ex killed 100% male and female beetles in 13 d. Mycotrol O killed about 86% of the beetles.
- The rate of kill from exposure to microbial formulations was different among sexes in preliminary studies; for example, Tick Ex killed 100% female beetles in 10 days compared to 75% males in the same time period. Mycotrol O killed 87% female beetles by 10th day after exposure but 81% male beetles in the same test.
- Field trial in commercial organic farm at Banks, AL, indicated YLB densities of about 10 beetles per turnip plant in May of 2007. Entrust (spinosyn, see earlier discussion on mode of action) was the only insecticide that provided quick reduction of YLB from 10 beetle/turnip plant to just 2/turnip plant with one early

season spray. All beetles were eliminated by Entrust after the second spray application.

- On the basis of leaf damage ratings (1 to 6 scale, 1 = under 10% defoliation), Entrust and row covers had 0 and 1.2 damage levels, respectively, indicating high effectiveness of the management tactics. Damage rating in control plots averaged about up to 30% defoliation.

The next page shows some of the sustainable agriculture initiatives in Alabama.

Fig. 1. Master Gardener Training Program

Fig. 2. Vegetable IPM Exhibition for farmers

Fig. 3 & 4. Sustainable Vegetable Production field days (2009-2011) attract numerous small and large crop producers for hands on training in crop production and protection techniques.

Fig. 5,6,7. Collaborative organic and low-input vegetable production conferences with Auburn & Tuskegee University Extension. Middle picture shows a group discussion completed recently for planning a large organic workshop in October 2011. Six Regional Extension Agents and many key farmers have participated in the insect monitoring program in Alabama.


Fig. 8,9. Organic No Till Field Day at Randle Farms, Alabama. Hundreds of farmers have participated in sustainable agriculture field days like these across the state.

Outcomes/Impacts

Program 1 - IPM in Fruit and Vegetable Crops: A strong program evaluation feedback system has been established for the Alabama IPM program. Feedback received in 2010 indicates need for further training of crop producers for pest identification, IPM adoption, and finding Extension information sources (e.g., publications). 68% producers use ACES website for IPM information; low resource farmers and organic producers are increasingly being served by the IPM program (12% increase in participation in two years).

Outcomes/impacts: In 2009 and 2010, the Commercial Horticulture Extension Team initially aimed at removing the two major barriers to IPM adoption (i.e., lack of awareness of IPM program and difficulty in accessing information) by conducting a statewide IPM campaign that directly reached to many low resource farmers through a variety of communication channels. In the past two years, the IPM campaign has educated about 686 vegetable producers in classrooms with 13+ hours of IPM training using actual insect specimens and simulated plant injury exercises. Use of the Southeastern U.S. Vegetable Crop Handbook (yearly updated) has reached to 75% in two years; vegetable producers are increasingly calling the Extension offices for assistance regarding insect pest identification and management issues suggesting increase in confidence in IPM information provided by this program. About 24% producers in Extension meetings indicated that they use the ACES Vegetable Entomology Website for pest management information (increase of 12% in two years) and the subscriptions to IPM newsletter has grown at the rate of 130% per year. Newsletter quality/impact assessment survey (n = 58) indicated that 44% respondents read the entire newsletter; also, 53% respondents read the newsletter for 15 minutes while 22% read it for over 30 minutes. About 53% respondents indicated that they used the IPM recommendations from the newsletter and six case studies (voluntary disclosure by respondents) suggested profits ranging from $500-1,000 per adoptive farmer. Over 93% newsletter subscribers support continuation of the publication because it keeps them abreast on various pest outbreaks, management technologies and Extension events across the state. The vegetable entomology Website receives about 100 hits per day during summer months and the IPM newsletter Web archive gets 171 hits per day during peak traffic resulting in continuous availability of useful information. The Facebook page has about 54 subscribers at present and younger farmers may join the list for information in coming years. The YouTube channel (IPMNews) receives about 42 hits per month. The quality of Dr. Majumdar's IPM class has been ranked highly satisfactory by over 90% respondents and the demand for hands-on IPM training has doubled in two years (e.g., 3 meetings in 2009, 7 meetings in 2010). In 2009 and 2010, Dr. Majumdar's IPM exhibit has been seen by 1,800 producers at major grower conferences including the Southern Sustainable Agriculture Working Group Annual Conferences (Chattanooga, TN), Alabama Fruit and Vegetable Annual Conference (Auburn, AL) and the Alabama Sustainable Agriculture Network's Farm & Food Forum (Selma, AL). Sponsorship for

entomology research program from large pesticide firms and farmers cooperatives has also helped to expand the IPM program to unexpected audiences (e.g., backyard vegetable producers, pesticide distributors, crop advisors, etc.). In a second (follow-up) IPM producer survey completed in 2010, results indicated that the average farm size of medium-scale vegetable farms (n = 55) was 23 acres and adoption of IPM recommendations saved about $248 per acre. These are very encouraging trends for the organic program in Alabama and it is expected that the impacts of the IPM program will keep rising with increasing participation of producers in future years.

Program 2 – Organic No-till Management in Small Scale Vegetables
We held 3 field days and invited the public to come and observe the no-till trials on two of the farms and on one of the research stations. We brought equipment and demonstrated their use. We explained the benefits of no-till production and participants were shown cover crops growing in the field. About 75 people attended the field days. All of the farmers are making progress toward developing an effective no-till system. Two of them are at the point of being able to establish a cash crop this summer without needing to till. The other 3 are adapting their approaches to insure success in the future.

Publications from IPM Program

Ivors, K. L., F. J. Louws, E. J. Sikora, T. Keinath, D. B. Langston, D. Ferrin, K. W. Seebold, D. Ingram, S. C. Bost and S. L. Rideout. (2010). Plant Disease Control for Commercial Vegetables. *In* Southeastern U.S. Vegetable Crop Handbook (J.M. Kemble, eds.). ANR-1344. Vance Publishing Corporation, Lincolnshire, IL.

Majumdar, A., Boozer, R., and Fadamiro, H. Y. (2010). A new statewide insect survey and rapid IPM information dissemination system. Southeastern Branch Annual Meeting, Entomological Society of America, Atlanta, GA.

Majumdar, A., Fadamiro, H.Y., and Boozer, R. (2010). Preliminary findings from the Alabama insect pest survey using pheromone traps. Southern Region American Society for Horticultural Science, Orlando, FL. 15 participants. HortScience. 45: 486-518.

Majumdar, A., and Fadamiro, H.Y. (2010). Organic and Sustainable Vegetable Production: Challenges to IPM Research, Education, and Technology Adoption. 58th Annual Meeting of the Entomological Society of America, San Diego, CA. 55 participants. Received $1,000 Program Enhancement Funds for 3 speakers.
(Presenters: Henry Fadamiro, Ayanava Majumdar, Auburn Univ.; Oscar Liburd, Univ. of Florida; Geoff Zehnder, Clemson Univ.; Randy Martin, BioWorks Inc; Jarrod Leland, Novozymes Inc; Karen Wynne, Organic Vegetable Producer; David Johnson, President-AL Fruit & Vegetable Grower Association; Mary Peet, USDA-NIFA Administrator). [Online]
http://esa.confex.com/esa/2010/webprogram/Session12815.html

Majumdar, A., Fadamiro. H.Y., and Boozer, R. (2010). Progress of vegetable entomology/IPM campaign in Alabama, Step 1: Training growers to monitor and identify pests. Annual Meeting of the Alabama Association of County Agricultural Agents and Specialists, Guntersville, AL.

Ojiambo, P. S., Holmes, G. J., Britton, W., Keever, T., Adams, M. L., Babadoost, M., Bost, S. C., Boyles, R., Brooks, M., Damicone, J., Draper, M. A., Egel, D. S., Everts, K. L., Ferrin, D. M., Gevens, A. J., Gugino, B. K., Hausbeck, M. K., Ingram, D. M., Isakeit, T., Keinath, A. P., Koike,

S. T., Langston, D., McGrath, M. T., Miller, S. A., Mulrooney, R., Rideout, S., Roddy, E., Seebold, K. W., Sikora, E. J., Thornton, A., Wick, R. L., Wyenandt, C. A., and Zhang, S. (2011). Cucurbit downy mildew ipmPIPE: A next generation web-based interactive tool for disease management and extension outreach. Online. Plant Health Progress doi:10.1094/PHP-2011-0411-01-RV.

Extension Bulletins, Pest Advisories, and Timely Information Sheets:
Abney, M.R., Walgenbach, J.F., Kennedy, G.G., Smith, P., Bessin, R., Sparks, A., Riley, D., Majumdar, A., Layton, M., Hale, F., and Morgan, A.L. (2010). Insect Control for Commercial Vegetables. *In* Southeastern U.S. Vegetable Crop Handbook (G.J. Holmes and J.M. Kemble, eds.). ANR-1344. Vance Publishing Corporation, Lincolnshire, IL. This publication has organic insect control recommendations, correct insecticide usage recommendations for conventional farmers, and listing of biological control agents for sustainable farmers.

Majumdar, A. (2010). Home Garden Vegetables: Insect Control. ANR-1305. [On-line] http://www.aces.edu/pubs/docs/A/ANR-0500-B/VOL2-2011/home_vegetable_insects.pdf

Majumdar, A., and Akotsen, C. (2010). Pest Management Issues in High Tunnel Crop Production. [On-line] http://www.aces.edu/timelyinfo/Horticulture/2010/July/July_2_2010.pdf

ALABAMA IPM COMMUNICATOR (e-newsletter):

Chief Editor: A. Majumdar, ACES Ext. Entomologist
Editorial board: Henry Fadamiro – Associate Professor of Entomology & Plant Pathology Department, Alabama IPM Coordinator; Clement Akotsen-Mensah – Graduate Research Assistant, Entomology & Plant Pathology Department; Cathy Sabota - Professor of Horticulture, Alabama A&M University; Conrad Bonsi — Professor and Associate Dean, Tuskegee University

Email subscriptions: 570
Issues released: 18
IPM articles published: ~300
Newsletter on Facebook (Alabama Vegetable IPM): 36 followers
Video Logs of IPM on YouTube (IPMNews): 42 hits per month

Newspaper reports:
Majumdar, A. (2010). Incidence of major insect pests in peanuts and vegetables. Baldwin Register & Gulf Coast Newspapers. June 22, 2010. Print circulation: 35,000.

Majumdar, A. (2010). Insecticides for backyard vegetable production. Baldwin Register & Gulf Coast Newspapers. April 6, 2010. Print circulation: 35,000. [Online] http://tinyurl.com/2a6bvkk

Majumdar, A. (2010). New insect control options are available for farmers. Baldwin Register & Gulf Coast Newspapers. January 13, 2010. Print circulation: 35,000. [Online] http://tinyurl.com/27mphl6

ACES Timley Information (statewide Extension reports):
Majumdar, A., and Powell, M. (2010). Net house vegetable production: Pest Management Successes and Challenges. Posted on December 12, 2010. [Online] http://www.aces.edu/timelyinfo/entomology/2010/December/Dec_2010.pdf

Majumdar, A. (2010). Report on Stink Bug and Leaffooted Bug on Vegetables. Posted on October 14, 2010. [Online]
http://www.aces.edu/timelyinfo/entomology/2010/October/October_%2012.pdf

Majumdar, A. (2010). Insecticides for garden vegetable production. Posted 20 April, 2010. [Online]
http://www.aces.edu/timelyinfo/entomology/2010/April/Backyard_Vegetable_Production2010.pdf

Magazine articles:
Majumdar, A. **(**2010). Results from the 2009 insect monitoring pilot project in Alabama. American Vegetable Grower (R. Gordon, ed.). Miester Media, MI.. [Online]
http://www.growingproduce.com/americanvegetablegrower/?storyid=4204

Majumdar, A. (2010). Pest patrol 101. American Vegetable Grower (R. Gordon, ed.). Miester Media, MI. 58 (8): 16-18. 27,000 subscriptions. [Online]
http://www.growingproduce.com/americanvegetablegrower/?storyid=4170

Participants
IPM in Fruit and Vegetable Crops:
Specialists: H. Fadamiro, A. Majumdar, E. Sikora, R. Boozer
Others: C. Akotsen-Mensah, R. Balusu, farmers
Extension Agents: L. Chapman, W. East, G. Gray, N. Kelly, J. Miles, M. Reeves, C. Becker, E. Wheeler, T. Glover
Partner organizations: **Alabama Sustainable Agriculture Network** (MAJOR PARTNER in organic programs), Alabama Fruit and Vegetable Growers Association, Southern Sustainable Agriculture Working Group. Collaborators included crop consultants, industry representatives, and farmers.
Opportunities for Profession Development included the Annual Meetings of the Alabama Fruit and Vegetable Growers Association (Auburn), Alabama Sustainable Agriculture Network (Birmingham), and Southern Sustainable Agriculture Working Group (Chattanooga, TN). Also, a statewide IPM training was provided via the Annual IPM Web Conference.

Target Audiences
Farmers (subcategories: large conventional, small organic and low resource farmers, organic gardeners)
Certified crop advisors
Industry representatives
Extension Agents
County Extension Coordinators
Pesticide distributors
Nursery and seed store owners
Local Food Production & Food Policy Organizations