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Diversification into Specialty Crops Production as a Regional Economic Development Strategy for Northeast Arkansas: An Economic Impact Analysis

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Abstract

This study evaluates potential economic impacts on the region that may result from diversifying into vegetable crops. Five vegetables: okra, Southern peas, snap beans, summer squash, and sweet potatoes are evaluated. The evaluations entail analyses of potential regional economic impacts, using IMPLAN 3.0. The results exhibit strong multiplier effects and economic contributions in the region to output, employment, value-added, and income generation. The results also show that vegetable production can be important source of indirect and induced economic activities in the region. These indicate that vegetable production can have positive impacts and linkages in the region's economy and may not be ignored in developing economic strategies for the region

Keywords: economic impact, IMPLAN, vegetable production, Northeast Arkansas agriculture

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Introduction

Despite the large agricultural land base in Northeast Arkansas, economic development strategies in the region have over the years continued to rely on the production of few core traditional row crops. Consequently, row crop agriculture production has become the mainstay of the region, with over 2,400,000 acres of cropland in the seven-county study region (Clay, Craighead, Crittenden, Cross, Greene, Mississippi, and Poinsett counties—see Figure 1). However, between 2006 and 2010 row crop prices were very volatile while production expenses continued to rise. Average earnings in the region fell by 2.5% while that of the entire state of Arkansas fell by 2.0%. Unemployment rate rose to 7.8% compared to 5.4% nationally. The region had one in every six jobs in row-crop agriculture. Average per capita income in the region fell to $21,000 compared to $28,000 nationally. These statistics contributed in making Northeast Arkansas one of the poorest regions in the country and prompted the Arkansas Economic Development Administration's interest in possible alternate crop diversification to revitalize the region's poor economy. Commercial-scale specialty crop production was considered as one such alternatives, given the region's widespread experience with garden-scale vegetable production and its past experience with commercial-scale vegetable production, during the 1920s through 1990s.

Figure 1. Study Region: Seven Counties of Northeast Arkansas (Clay,Cross, Craighead,Poinsett, Green, Crittenden, Mississippi

This study evaluates the potential employment and economic impacts on the region that could result from expanded production of specialty crops. Five specialty crops: okra, southern peas, snap beans, summer squash, and sweet potatoes are evaluated. The evaluations entail economic

analyses of the five specialty crops, and an assessment of the potential regional economic impacts, using POLYSIS simulation and IMPLAN.

The economic analyses of the specialty crops include estimated production expenses, farm gate revenues, and net income. For each crop, a theoretical threshold of net income versus selling prices is established using estimated "processing grade" prices for the low end and USDA Terminal prices for the high end. Four net income scenarios: the farm gate price required to achieve a net income of $200 per acre per year- an estimated average net income per acre per year from conventional row crops grown in the region, and the farm gate price required to achieve a net income scenario of $1500—an estimated average net income per acre per year that may entice row crop producers to switch to the specialty crop in question.

Quantities of viable specialty crops that can be produced in the seven counties-region are determined by simulating price changes on the USDA baseline of the region's agricultural sector. In addition, POLYSIS simulation output of the changes on net farm incomes, prices, and land use changes for each of the specialty crop price scenarios, are aggregated to the county level and incorporated into IMPLAN, which provides information on changes in the regional economy as measured by total industry output and employment at the state and county levels. Unlike other non-farm economic sectors, the agricultural sector's resources in the region are not very mobile. Once the resources are employed by the agricultural sector they tend to be rigid or static in that sector. Northeast Arkansas (NEAR) farmers tend to use all of their productive capacity regardless of expected commodity prices.

Methods

Two steps are used to develop the economic impact analysis. First, a crop budget and four price scenarios for each of the five vegetables crops—southern peas, okra, snap beans, summer squash, and sweet potatoes are developed. Information on the crop budgets, prices and acreage to be planted with each vegetable are also developed. Next, this information is then used to estimate the impact that vegetable production will have on the economies of each of the seven counties using IMPLAN (IMPLAN 2010), an input-output modeling system.

IMPLAN is an acronym for "Impact analysis for Planning". The IMPLAN System comprises of software and regional data sets. For the purposes of this study changes that occur from the baseline are estimated and used as input to IMPLAN (IMPLAN 2010). Once IMPLAN is solved, information at the county level regarding changes in total industry output and employment is estimated for each sector of the economy.

POLYSYS

POLYSIS consists of a large-scale, comprehensive quantitative group of models of the US agricultural sector and that of some international countries. The analysis in this study uses the output from POLYSYS, simulation model of the region's agricultural sector that includes county level aggregate income modules, demand, and supply of agricultural products, and integrates that output into IMPLAN. Many POLYSYS model groups and IMPLAN have designed and published10-year USDA baseline projections and multipliers for the US agricultural sector for the counties in all the 50 states, and these models simulate deviations from the baseline. The

POLYSYS baseline module for the state of Arkansas includes eight major row crops (cotton, rice, soybeans, grain sorghum, oats, barley, and wheat that are mainly produced in Northeast Arkansas. The emphasis in this study is on how shifting row crops land to specialty crops production affects crop prices, farm incomes, and taxes paid to the government by farmers in the region. Changes in growers output and incomes resulting from specialty crops diversification are used for our POLYSIS simulation using the following model:

$$(1) \qquad \Delta \mathrm{GI}_{\boldsymbol{m.i.j.c}} = \sum_{j=1}^{5}(GR^{s}{}_{m.i.j.c} - \sum_{c=1}^{8}(GR^{b}{}_{m.i..c}$$

Where:

$\Delta \mathrm{GI}_{\boldsymbol{m.i.c}}$ is the change in growers' incomes for year (m), county (i), specialty crop (j), and row crop (c), $GR^{s}{}_{m.i.j.c}$ is the gross return for price scenario(s), for year (m), county(i), specialty crop (j), and row crop (c). $GR^{b}{}_{m.i..c}$ is the net return for the baseline price in POLYSIS for year (m), county(i), and row crop (c). The changes in growers' incomes for producing a specialty crop were summed over each crop and the result was placed in the model, along with total industry output for each row crop. The POLYSYS simulation outputs are then integrated into IMPLAN. The POLYSYS and IMPLAN models are combined to provide a detailed picture of the region's agricultural sector, potential impacts of growing specialty crops, and the impacts to the region's economy as row crop producers diversify into specialty crops production.

For the analysis, we used a price scenario that could earn specialty crop growers $200 net income per acre, the average net income for row crop producers in the region.

Price Scenario Development

Farm gate price data for different grades of the five specialty crops were unavailable, as a result, we developed four farm gate pricing scenarios for each of the five specialty crops for our analysis:

Price 1 scenario is the estimated processing grade price (if the entire crop were to be sold at that price). Price 2 scenario is the estimated farm gate price required to achieve a target net income of $200 per acre per year. Price 3 scenario is the estimated farm gate price required to achieve a target net income of $1,500 per acre / year that may entice row crop producers to switch to the specialty crop in question. Price 4 scenario is the estimated USDA Terminal price (if the entire crop were sold at that price).

Table 1. Estimated average agronomic yields and market clearing prices selected vegetables.

Price Scenarios		**Southern Peas**	**Okra**	**Snap Beans**	**Summer Squash**	**Sweet Potatoes**
Scenarios	Yield, pounds per year	1,000	12,000	5,750	10,500	18,000
Price1	Processing grade prices	$0.450	$0.220	$0.090	$0.190	$0.10
Price 2	Prices to achieve $100/acre	$0.924	$0.888	$0.222	$0.231	$0.11
Price 3	Prices to achieve $1,500/acre	$2.324	$1.355	$0.466	$0.36	$0.19
Price 4	USDA Terminal prices	$0.739	$1.463	$0.860	$0.70	$0.43

Terminal prices are wholesale prices for fruits and vegetables sold at selected U.S terminal markets. These terminal prices are compiled regularly by the USDA's Agricultural Marketing Service and are to a limited extent differentiated by the commodity's growing origin, variety, size, package and grade. The Terminal prices used in this analysis, are the average values for all grades for each specialty crop during 2010 at the three closest terminals to the region (Saint Louis, Atlanta, and Dallas).

Incorporating Changes in Growers Incomes and Output from POLYSIS Simulation into Region's IMPLAN Data Base

POLYSYS and IMPLAN models are combined to provide a detailed picture of the region's agricultural sector, potential impacts of growing specialty crops, and the impacts to the regional economy as row crop producers diversify into specialty crops production. The POLYSYS simulation output from the changes in growers' incomes, output, and acreage are placed into IMPLAN for impact analysis.

IMPLAN (Impact analysis for Planning) is an economic impact modeling system, developed by MIG, Inc. (Formerly Minnesota IMPLAN Group, Inc.). IMPLAN uses a Input / Output analysis (I/O). Input / Output analysis recognizes that relationships exist between industry groups and households, and quantifies the flow of dollars as transactions occur between these parties, and as value is added to a product or service from the producer to the final customers (Leontief 1936). IMPLAN has produced customized, location-specific social and economic characteristics and demographics of the location selected (IMPLAN 2010).

IMPLAN's social accounting system describes transactions that occur between producers, input suppliers, intermediate and final consumers by using social accounting matrix. IMPLAN's Social accounting matrices have been used in many impact studies including evaluating the economic impacts of bioenergy crop production on U.S. agriculture (De La Torre Ugarte et al. 2000). Because of its ability to provide detailed input-output impacts in any local economy, the methodology used in this study has been used in various localized impact studies (Schmit. et al. 2013; Mulkey. et al. 2012). The IMPLAN model can also be used for predictive purposes, by providing estimates of multipliers. Multipliers measure the response of a region's economy to a change in demand or production in the region This study uses IMPLAN 3.0 software and 2008 through 2010 Northeast Arkansas industrial sector (NAIC) data for the analysis (IMPLAN 2010).

Crop Budgets

The study estimated four price scenarios for each of the specialty crops. Crop budgets are developed for each of the specialty crops.

We created custom budgets for each specialty crop using crop budgets developed by the university of Arkansas (based on the jointly prepared vegetable crop budgeting model developed by multi states land-grant universities in Mississippi, Arkansas, Louisiana, Tennessee, Alabama and Georgia also called the MALTAG group). However, we incorporated additional unique expenses and our price scenarios to create custom budgets for each of the five crops using

Microsoft Excel so that additional unique expenses and our price scenarios could be incorporated and used for the analyses. A summary table of the custom budgets for each crop is shown in Table 2.

Table 2. Summary Specialty Crop Budgets

	Southern Peas	Okra*	Snap Beans	Summer Squash	Sweet Potatoes
Revenues	$1,024	$10,458	$1,378	$2,522	$2,079
Variable/operating expenses					
Fertilizer	53	502	41	87	68
Custom operations	$24	96	24	24	40
Agricultural chemicals					
Fungicides	–	–	25	25	30
Herbicides	10	35	32	–	23
Pesticides	16	84	19	11	288
Seeds/planting stock	20	5555	147	258	195
Irrigation	195	780	195	195	20
Other expenses				356	
Labor	107	288	110	338	206
Fuel	118	228	127	93	102
Repair and maintenance	24	31	32	11	19
Irrigation	27	1296	155	210	540
Subtotal variable Opex	$594	8895	907	1608	1531
Gross income	$430	$1,563	$471	$914	$548
Fixed operating expenses					
Land	50	200	50	50	50
Equipment owning cost	99	181	108	441	117
Interest on Capex	14	152	16	35	30
Subtotal fixed Opex	163	533	174	526	197
Operating income	$267	$1,030	$297	$388	$351
Management and overhead					
Farm management	30	369	43	84	67
Farm overhead	37	461	54	104	84
Subtotal M&A	67	830	97	188	151
Net Income	$200	$200	$200	$200	$200

Note. * Because of its high projected crop failures, four years of total expenses/revenues are used for Okra.

Acreage Data

The USDA 2007 Agricultural Census reports less than 1% or only 2,100 acres of specialty crops in the region, but does not break it out by crop type, and no other data was located that provides production information for the region by specialty crops. However, during the 1920s when the region had the highest acreage in commercial specialty crops production, only 5% of its cropland was devoted to specialty crops production. This study estimated 5% of the region's cropland for specialty crop diversification. The estimated acres are based on private discussions with

vegetable brokers / processors who have obtained specialty crops from the region in the past, and growers in the region. There are currently 2,400,000 acres of cropland within the seven-county region; thus, a total of 12,000 acres would entail re-directing 5% of the region's farmland to vegetable production.

Results and Conclusions

The results from the IMPLAN analysis provide an indication of the effect of the structural changes that can occur in the region's traditional row crop production, income generation, and output resulting from diversifying into specialty crops. Table 3 shows the summary results.

Table 3. Estimated Total Regional Impacts from Specialty Crops Diversification.

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	215	$18,300,000.00	$14,600,000.00	$25,300,000.00
Indirect Effect	39	$1,400,000.00	$2,100,000.00	$3,600,000.00
Induced Effect	48	$1,400,000.00	$3,300,000.00	$5,400,000.00
Total Effect	302	$21,100,000.00	$20,000,000.00	$34,300,000.00

The results in Table 3 show that specialty crops production can have potential positive multiplier effects and economic contributions in the region in terms of output, employment, value-added, and income generation. These indicate that specialty crops production can be an important sources of indirect and induced economic production activities in the region. It also indicates that specialty crops production can have positive economic impacts and linkages in the region's economy and it must not be ignored when developing economic strategies for the region. The total regional impact results are *net* of employment, output, value added and income impacts that are associated with row crops that would be foregone if production of specialty crops were to be expanded to replace the 12000 acres that would have been used to produce row crops. For example, the 302 FTE employment created from expanded specialty crops production in the region reflect the total employment created from specialty crops production net the total employment associated with 12,000 acres of conventional row crops that would have been lost in the region by not producing row crops. Although Table 4 shows that expanded production of each of the five specialty crops in the region will have positive economic impact, sweet potatoes seem to have the highest economic impact in terms of employment income generation and output. The results of this study has also shown that to properly measure the economic impact and contribution of specialty crops to a region's economy, account must be taken of its potential effects on the generation of income, output, value-added and employment. As a major row crop production region, it is clear that while specialty crops may receive very little attention in terms of production and economic contribution in the region, this impact analysis shows that specialty crops have the potential to be important economic engines in the Northeast Arkansas region and that specialty crops production may not be ignored when designing agricultural development strategies for the region. This study has also shown that to properly measure the economic impact and contribution of specialty crops production to Northeast Arkansas region's economy, account must be taken of its effects on the generation of income, output, value-added and employment.

Table 4. Detail Regional Impacts from Specialty Crops Diversification.

	Employment	Labor Income	Value-Added	Output
Southern Peas				
Direct Effect	33	$3,900,000	$2,900,000	$5,500,000
Indirect Effect	10	$300,000	$600,000	$900,000
Induced	11	$300,000	$800,000	$1,200,000
Totals	54	$4,500,000	$4,300,000	$7,600,000
Okra				
Direct Effect	32	$2,600,000	$2,100,000	$3,600,000
Indirect Effect	6	$200,000	$300,000	$500,000
Induced	7	$200,000	$500,000	$800,000
Totals	45	$3,000,000	$2,900,000	$4,900,000
Snap Beans				
Direct Effect	27	$2,500,000	$1,900,000	$3,400,000
Indirect Effect	5	$200,000	$200,000	$500,000
Induced	6	$200,000	$400,000	$700,000
Totals	38	$2,900,000	$2,500,000	$4,600,000
Summer Squash				
Direct Effect	31	$2,600,000	$2,100,000	$3,700,000
Indirect Effect	6	$200,000	$300,000	$500,000
Induced	7	$200,000	$500,000	$800,000
Totals	44	$3,000,000	$2,900,000	$5,000,000
Sweet Potatoes				
Direct Effect	92	$6,700,000	$5,600,000	$9,100,000
Indirect Effect	12	$500,000	$700,000	$1,200,000
Induced	17	$500,000	$1,100,000	$1,900,000
Totals	**121**	**$7,700,000**	**$7,400,000**	**$12,200,000**

Source. IMPLAN 3.0, 2010 IMPLAN Results

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