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Estimating the Economic and Fiscal Impacts to Appalachian Ohio Communities Resulting from Adoption of High Tunnel Berry Production Methods

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ABSTRACT

Recent research has found that berries are a viable cash crop alternative to tobacco, the former mainstay of a number of the southern Ohio counties the region. To help inform local officials and the agricultural community of the viability of high tunnel production methods, this study aimed to estimate the economic and fiscal impacts of an extended berry growing season and expanded berry processing industry resulting from adoption of such methods in three regional economies in southern Ohio. IMPLAN software and personal interviews with local decision-makers were used to estimate impacts. It was estimated that adoption of such methods would affect the local economy and county coffers by less than one percent.

Introduction

Much of Appalachian Ohio has struggled economically relative to the rest of Ohio due to the nature of agricultural production and lack of employment opportunities in this region (Isserman, 1996). Small farms and with limited resources characterize the landscape and economy of much of Appalachian Ohio. Historically, small farms in this region and the communities they support have depended heavily upon tobacco for income (Batte, 2004). Recent public health policy has focused on reducing tobacco production and advertising across the U.S. The resulting reduction in tobacco production has exacerbated economic challenges facing rural communities in Appalachian Ohio.

Recent research has found that berries are a viable small farm production alternative to tobacco. Innovative new high tunnel production methods can extend the berry growing season and make berry farming more profitable. Understanding the potential benefits of this practice in the communities in which such benefits occur can help inform local officials and the agricultural community of the viability of such a production method.

The objectives of this study were to identify:

1. The economic impact of increased berry production and berry processing in three regional case study economies
2. The fiscal impact of increased berry production and berry processing in three regional case study economies.

Methodology

Economic Impact Analysis

Three regional Ohio economies in southern Ohio were studied. The regions included Highland County, Morgan County, and Ross County and their respective contiguous counties.

For this study, the impact of a change on the local economy, which includes changes in number of jobs, wages, and local income comprised the analysis. To estimate economic impact an IMPLAN-generated input-output model was used. IMPLAN employs existing from the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, the U.S. Department of Agriculture Crop and Livestock Statistics, the U.S. Geological Survey, and the U.S. Census Bureau to generate economic multipliers (IMPLAN, 2004; *The IMPLAN Input-Output System*, 2003).

$$Multiplier = \frac{\text{estimated total effect resulting from a given economic "shock" to the economy}}{\text{smaller partial effect, namely the direct project} - \text{or activity} - \text{specific effect}}$$

A multiplier can be considered an empirical quantification of the strength of the economic linkage between an economic sector or a given industry and the rest of the regional economy. Typically, the greater the extent of the linkage, the greater the size of the multiplier. The greater the multiplier, the greater the economy-wide dollar or employment impact of any given stimulus to one industry or sector of the economy (Kay, 2002).

A model was constructed for each study region based on the assumption that berry production could be increased by 20 percent over existing levels. To estimate impact resulting from changes in the berry processing sector, the creation of 6 new jobs in that sector was assumed.

Direct, indirect, and induced economic effects were estimated. Direct effects include the production changes associated with the immediate effects or final demand changes from increased berry production and/or processing. Indirect effects include production changes in backwards linked industries caused by the changing input needs of directly affected industries such as suppliers to the berry production and/or processing. Lastly, induced effects are the changes in regional household spending patterns caused by changes in household income generated from the direct and indirect effects.

Models were populated with county-level data from the IMPLAN databases. In this study, the database used was released in February 2008, which includes economic data from the year 2006.

Fiscal Impact Analysis

The fiscal impact analysis was modeled after Roe, et al (2003) who estimated the fiscal impact of newly constructed dairy farms in two northwestern Ohio counties (Roe, et al, 1). Similar to Roe et al, state and local incentive programs, monetary gifts to the counties in the region, fiscal impacts on local schools, the change in road maintenance costs, projected revenues with and without the new enterprises, inflation, and nominal and net present values comprised the basis for the analysis.

Additionally, information about local tax structures and tax incentives for new or expanding businesses was gathered via personal interviews of local officials. The interview was conducted face-to-face with the county economic development directors and local Ohio State University Extension personnel in Highland, Morgan, and Ross counties involving development issues/tools such as: county millage rates, tax incentive programs, low interest financing programs, availability of land for expanded production and/or processing, and

estimated costs for potential infrastructure improvements.

For the purposes of this study, a 10% increase in processing employment was used to estimate the potential economic and fiscal impacts of additional new processing employment resulting from additional berry production in the study region.

Results and Discussion

Economic Impact

The 10 most impacted sectors (by region) in terms of annual impact to sales, employee compensation, and proprietor income resulting from a 20% production increase are illustrated in Table 1 (below). The sector that was impacted the most in terms of employee compensation, sales and proprietor income for all three regions was the fruit farming sector.

Total Estimated Annual Impact* Resulting from a 20% Production Increase
10 Most Impacted Sectors – By Region

	Highland Region		Morgan Region		Ross Region	
Rank	**Sector**	**Impact**	**Sector**	**Impact**	**Sector**	**Impact**
1	Fruit farming	$711,251	Fruit farming	$1,106,053	Fruit farming	$731,803
2	Agriculture and forestry support services	$55,694	Accounting and bookkeeping services	$43,798	Agriculture and forestry support activities	$27,166
3	Owner-occupied dwellings	$21,101	Petrochemical manufacturing	$16,916	Owner-occupied dwellings	$22,286
4	Truck transportation	$13,290	Owner-occupied dwellings	$16,551	Food services and drinking places	$10,568
5	Food services and drinking places	$9,901	Real estate	$12,385	Offices of physicians-dentists-and other health	$8,749
6	Offices of physicians-dentists-and other health	$8,354	Offices of physicians-dentists-and other health	$12,299	Hospitals	$8,170
7	Hospitals	$6,966	Wood container and pallet manufacturing	$10,451	Real estate	$7,654
8	Real estate	$6,360	Truck transportation	$10,054	Monetary authorities and depository credit services	$6,929
9	Monetary authorities and depository credit services	$5,061	Hospitals	$9,410	Wood container and pallet manufacturing	$5,942

10	Other state and local government enterprises	$4,699	Other state and local government enterprises	$8,506	Other state and local government enterprises	$5,541

***Sum of estimated employee compensation, output, and proprietor income impacts**

Table 1 Total Estimated Annual Impact of 20% Production Increase: 10 Most Impacted Sector

The 10 most impacted sectors (by region) in terms of annual employment resulting from a 20% production increase are illustrated in Table 2 (below). Again, the fruit farming sector was most impacted in terms of annual employment given the 20 percent increase in all three regions.

Estimated Annual Employment Impact Resulting from a 20% Production Increase 10 Most Impacted Sectors – By Region

	Highland Region		Morgan Region		Ross Region	
Rank	**Sector**	**Impact**	**Sector**	Rank	**Sector**	**Impact**
1	Fruit farming	16.42	Fruit farming	13.43	Fruit farming	9.80
2	Agriculture and forestry Support services	0.87	Agriculture and forestry support services	0.84	Agriculture and forestry support services	0.49
3	Food services and Drinking places	0.12	Food services and drinking places	0.10	Food services and drinking places	0.13
4	Animal production	0.05	Real estate	0.07	General merchandise stores	0.04
5	Cattle ranching and farming	0.05	Warehousing and storage	0.05	Real estate	0.04
6	General merchandise stores	0.04	Health offices	0.05	Nursing and residential care facilities	0.04
7	Food and beverage stores	0.04	Wood container and pallet manufacturing	0.05	Food and beverage stores	0.04
8	Nursing and residential care facilities	0.04	Hospitals	0.05	Health offices	0.04
9	Health offices	0.04	Truck transportation	0.04	Civic organizations	0.04
10	Oilseed farming	0.04	Civic organizations	0.04	Grain farming	0.04

Table 2 Total Estimated Annual Employment Impact of 20% Production Increase: 10 Most Impacted Sectors

The 10 most impacted sectors (by region) in terms of annual impact to sales, employee compensation, and proprietor income, resulting from the addition of six FTEs in berry processing are illustrated in Table 3 (below). The 10 most impacted sectors (by region) in terms of annual employment resulting from the addition of six FTEs in berry processing are illustrated in Table 4 (below).

Total Estimated Annual Impact* Resulting from a 6 FTE Increase in Berry Processing - 10 Most Impacted Sectors – By Region

	Highland Region		Morgan Region		Ross Region	
Rank	**Sector**	**Impact**	**Sector**	**Impact**	**Sector**	**Impact**
1	Fruit and vegetable canning and drying	$2,333,103	Fruit and vegetable canning and drying	$2,333,103	Truck transportation	$90,100
2	Frozen food manufacturing	$1,914,266	Truck transportation	$201,390	Owner-occupied dwellings	$29,530
3	Truck transportation	$291,490	Glass container manufacturing	$61,871	Management of companies and enterprises	$28,387
4	Wholesale trade	$71,631	Wholesale trade	$45,370	Wholesale trade	$26,738
5	Management of companies and enterprises	$58,100	Fruit farming	$35,503	Meat processed from carcasses	$25,930
6	Owner-occupied dwellings	$57,582	Plastics manufacturing	$33,134	Monetary authorities	$23,192
7	Monetary authorities	$53,919	Monetary authorities	$31,176	Food services and drinking places	$20,857
8	Fruit farming	$35,503	Power generation and supply	$30,548	Animal slaughtering	$19,729
9	Warehousing and storage	$16,718	Management of companies and enterprises	$29,713	Plastics manufacturing	$16,535
10	Health offices	$11,678	Owner-occupied dwellings	$28,052	Warehousing and storage	$7,435

Table 3 Total Estimated Annual Impact of 6 FTE Processing Increase: 10 Most Impacted Sectors

Estimated Annual Employment Impact Resulting from a 6 FTE Increase in Berry Processing - 10 Most Impacted Sectors – By Region

	Highland Region		Morgan Region		Ross Region	
Rank	**Sector**	**Impact**	**Sector**	**Impact**	**Sector**	**Impact**
1	Frozen food manufacturing	6.01	Fruit and vegetable canning and drying	6.00	Frozen food manufacturing	6.01
2	Fruit and vegetable canning and drying	6.00	Truck transportation	1.32	Truck transportation	0.59
3	Truck transportation	1.91	Fruit farming	0.68	Food services and drinking places	0.38
4	Food services and drinking places	0.82	Food services and drinking places	0.44	Warehousing and storage	0.20
5	Fruit farming	0.68	Warehousing and storage	0.30	Employment services	0.16
6	Warehousing and storage	0.50	Wholesale trade	0.26	General merchandise stores	0.16
7	Wholesale trade	0.41	Civic organizations	0.19	Wholesale trade	0.15

8	Civic organizations	0.34	Monetary authorities	0.16	Cattle ranching and farming	0.15
9	Monetary authorities	0.16	Management of companies and enterprises	0.16	Food and beverage stores	0.15
10	Employment services	0.16	Glass container manufacturing	0.16	Civic organizations	0.15

Table 4 Total Estimated Annual Employment Impact of 6 FTE Processing Increase: 10 Most Impacted Sectors

The magnitude of impact differed across the various economic sectors and from region to region. For example, in the Highland and Morgan regions the fruit and vegetable drying and canning sector felt the greatest impact in terms of impact to annual sales, employee compensation, and proprietor income as a result of a change in production. Conversely, it was the truck transportation sector in the Morgan region which felt the greatest production-related impact in terms of changes to annual sales, employee compensation, and proprietor income. A change in berry processing impacted the annual employment in the frozen food manufacturing sector most in the Highland and Ross regions. In Morgan region, fruit and vegetable drying and canning was still the sector that was impacted the most with the increase in berry processing.

The employment, employee compensation, proprietor income, and output multipliers for berry production were comparable across the three regions (see Table 5).

Production Economic Multipliers by Region (Type SAM)			
Category	**Highland Region**	**Morgan Region**	**Ross Region**
Employment	1.12	1.16	1.16
Employee Compensation	1.35	1.96	1.23
Proprietor Income	1.38	1.17	1.33
Output/Sales	1.35	1.23	1.33

Table 5 Berry Production Economic Multipliers - All Regions (Type SAM)

The Morgan region has the highest economic multiplier in terms of employee compensation. Per these multipliers, one would expect the greatest estimated impact to employee compensation resulting from expansion of berry production to take place in the Morgan region.

The Highland region is impacted the most in terms of proprietor income and output/sales when berry production is increased. As such, one would expect that an expansion of berry production would yield higher output/sales and proprietor income in the Highland region than in the other two regions.

The employment, employee compensation, proprietor income, and output multipliers for berry processing were much more varied across the three regions as compared to the production multipliers. An increase in berry processing has the greatest estimated impact overall in the Morgan region, relative to the Highland and Ross regions (see Table 6).

Processing Economic Multipliers by Region (Type SAM)			
Category	Highland Region	Morgan Region	Ross Region
Employment	2.08	2.33	1.83
Employee Compensation	2.32	3.07	1.57
Proprietor Income	2.14	3.03	1.65
Output/Sales	1.34	1.38	1.30

Table 6 Berry Processing Economic Multipliers - All Regions (Type SAM)

Fiscal Impact

Costs and benefits to schools and local government are county-based. As such, the county rather than the region served as the level of analysis for the estimating fiscal impact. Fiscal impacts were estimated by comparing the potential benefits to schools and local governments resulting from changes to property taxes and income taxes to potential costs associated with an increase in berry production and processing in Highland, Morgan and Ross counties.

It is estimated that a 20% increase in berry production would contribute no significant new income or added substantial cost to local government of all three counties.

It is estimated that gains to the local governments (and schools) via property taxes resulting from a 20 percent increase in berry production would be relatively insignificant. A key assumption is that land currently used for agricultural production would be used for increased berry production and therefore, new property tax revenues for increased berry production would be negligible. Land valuation would not change substantially, therefore the property tax revenues would not increase.

Given a 20 percent increase in berry production sales, Highland County and Ross County would receive nominal additional school income tax revenues (see Table 7).

Region	Public schools income tax rates	Estimated additional school income tax collections (per annum)
Highland	1.0% to 1.25%	$92 to $115
Morgan	0%	$0
Ross	0.5% to 1.0%	$203 to $407

Table 7 Public Schools Income Tax Rates and Estimated Additional School Income Tax Collections Per Annum with 20 Percent Increase in Berry Production Sales

The financial burden to local governments and schools resulting from a 20 percent increase in berry production was determined to be negligible. Again, land currently used for agricultural production would be used for increased berry production and expenses associated with an increase in berry production would be negligible as there would be no net change in land use for agricultural production and thus, no change in costs to provide services to that land use. In addition, neither development incentives nor infrastructure improvements would be required that would adversely affect counties governments' finances (including schools) in order to expand berry production in those counties.

Similar to the fiscal impact of increased berry production, the estimated cost and benefits of adding six FTEs in the berry processing sector are relatively insignificant as well.

It is estimated that each county would accrue marginal benefits from the addition of new property taxes and income tax revenues from the creation of six FTEs in berry processing (see Table 8).

Region	New property tax (per annum)	Estimated additional school income tax collections (per annum)
Highland	$3957 to $4777	$3074 to $3843
Morgan	$4312 to $4808	$0
Ross	$4630 to $5806	$1537 to $3074

Table 1 Estimated New Property Tax Revenues and Estimated Additional School Income Tax Collections Per Annum with 6 FTEs Increase in Berry Processing

It is estimated that increased berry processing would not create additional costs to the local governments and schools in all three counties of any significance. Additionally, neither development incentives nor infrastructure improvements would be necessary that would adversely affect county governments' finances (including schools) in order to add 6 FTEs to the berry processing industry. Costs to schools (pupil costs) were negligible as well with the increase in berry processing.

In summary, the total annual estimated fiscal impacts for each county given a 20 percent increase in berry production and a 6 FTE increase in berry processing range from $4312 to $9287 (Table 9).

	Total Annual Estimated Fiscal Impact	
	Production	**Processing**
Highland	$92-$115	$7031 to $8620
Morgan	$0	$4312 to $4808
Ross	$203-$407	$6167 to $8880

Table 9 Total Annual Estimated Fiscal Impact by Region

Summary and conclusion

The estimated economic and fiscal impacts associated with adoption of high tunnel berry production methods were relatively modest for these study regions.

Increase in Berry Production

The differences of overall economic impact across all three regions are not statistically significant.[1] As such, it is difficult to determine which of the three regions would experience the greatest estimated impact on overall.

For example, in general, the Morgan region would benefit from the greatest estimated economic impact from expansion of berry production based on its average (or total) economic multipliers across all categories. However, if rank sum were considered, the Highland region would enjoy the greatest estimated economic impact overall from an expanded berry production sector.[2]

[1] The Friedman's Distribution-Free Test for Unordered Alternative (nonparametric statistical test) was used. The three regions were used as treatments and the four categories of economic multipliers were treated as blocks. The differences were insignificant even at α value of 0.125.The p-value for the test is greater than 0.125.

[2] The rank sum method is part of the Friedman's Test procedure (see footnote 1). This rank sum method must not be confused with the Wilcoxon Rank Sum Test.

Each region (treatment) multiplier is ranked within its respective category (block). For example, in the output/sales category, Morgan region's multiplier is smallest, thus it receives a rank 1. Ross region's output/sales multiplier receives a rank 2 and Highland's is assigned the 3rd rank. This procedure is repeated for all categories. In the case of ties, average rank within the

The sum of ranks of the Highland region's economic multipliers is highest compared to the Morgan and Ross regions. Therefore, an increase in berry production would be most impactful overall in the Highland region, disregarding the statistical insignificant differences.[3]

Increase in Berry Processing

Similar to the impacts of increased production, it is estimated that the impact of processing across all three regions is statistically insignificant as well. This was determined through application of statistical test similar to that which was applied to increased berry production.[4]

If the insignificant differences were disregarded, inferences can be made about which county would be most impacted from an expansion in berry processing. Using the average economic multipliers across all categories in each region, the Ross region scores the highest, due to its high proprietor income multiplier and thus, would enjoy the greatest impact from increased processing activity compared to the other two regions. However, using the rank sum method described earlier, the effects of an expansion of berry processing would be felt most overall in the Morgan region compared to the other two regions.[5]

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block is used. Then, for each region, the ranks of all its multipliers are summed up.

[3] Use of rank sum is more equitable than the raw average of all the multipliers in a particular region. Due to the present of outliers, such as the observation in output/sales multiplier for the Morgan County may render the average method an unreliable estimate of which county will receive the greatest economic impact compared in overall.

[4] See footnote 1.

[5] Again, in this case, the average method is less reliable in determining which county receives the greatest economic impact given the expansion of the berry processing sector. In this case, even though Ross region has the highest average, its economic impacts on employment, employee compensation and output/sales are the smallest relative to the other two regions. In contrast, Morgan region's economic multipliers shows that the county stands to receive far greater impact in all those three aspects. It may be more equitable to consider more aspects rather than just one aspect alone when it comes to determining which county receives the greatest economic impacts overall. Therefore, it is more reasonable to conclude that expansion of berry processing will be most successful in overall in Morgan region.

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