



United States
Department
of Agriculture

VGS-342-02

February 2011



A Report from the Economic Research Service

www.ers.usda.gov

Fruit and Vegetable Planting Restrictions: Analyzing the Processing Cucumber Market

**Barry Krissoff, Mesbah Motamed,
Edwin Young, and Chengxia You**

Abstract

This report highlights the anticipated consequences of the 2008 Farm Act's Planting Transferability Pilot Program (PTPP) on processing (pickling) cucumber plantings. PTPP allows program crop growers in seven Upper Midwestern States to reduce base acres and plant select vegetables for processing on those acres without reducing Government payments on their remaining base acres. Stagnant market demand and the farmers' ability to enter or expand processing cucumber production without the pilot program may explain why the acres planted to pickling cucumbers may increase only marginally. Our findings suggest that PTPP would increase production by 180 acres, or by less than 0.5 percent of acreage in the Upper Midwestern States. About half an average-sized cucumber farm (43 acres) would be created in the region due to PTPP and an additional 137 acres would be planted by existing processing cucumber growers. With these small changes in regional cucumber acreage, PTPP is not likely to affect the national market and price outlook. The availability of nonbase acres, prior planting history, and distance to a processor are significant variables in determining planted cucumber acres.

Keywords: Planting flexibility, processing vegetables, pickling cucumbers, nonbase acres, Planting Transferability Pilot Program (PTPP), agricultural policy

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Approved by USDA's
World Agricultural
Outlook Board

Acknowledgments

The authors appreciate the input and data shared by colleagues at USDA's Farm Service Agency (FSA): Sandy Bryant, Joy Harwood, and Brent Orr. We also would like to thank the reviewers for their comments: Joe Balagtas (Purdue University), Joy Harwood (FSA), Brad Rickard (Cornell University), Suzanne Thornsbury (Michigan State University), Bernard Zandstra (Michigan State University), and our colleagues from Economic Research Service—Molly Garber, Lewrene Glaser, Suchada Langley, Gary Lucier, and Donna Roberts. The authors also benefitted from communication with Daniel Ford (FSA), Tom Hockert (FSA), Paul Mitchell (University of Wisconsin), and James Woodley (FSA). Thanks also to Angela Anderson and Cynthia A. Ray for editorial and design assistance.

The use of commercial and trade names does not imply approval or constitute endorsement by USDA.

Planting Flexibility Offered by the 2008 Farm Act

This report previews the effects of the 2008 Food, Conservation, and Energy Act's (henceforth referred to as the Farm Act) Planting Transferability Pilot Program (PTPP), with a special focus on cucumbers planted for processing (pickling). Designed to observe how markets might respond to greater flexibility, PTPP permits farmers in seven Upper Midwestern States (Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin) to reduce base acres and plant select vegetables for processing (cucumbers, green peas, lima beans, pumpkins, snap beans, sweet corn, and tomatoes) on those acres without foregoing Government payments on their remaining base acres. Base acres are defined as the amount of a farm's acreage eligible for commodity program payments.

PTPP emerged in response to claims by Midwestern vegetable processors that access to vegetables for pickling, tomato paste, and canned beans, among other foods, has been constrained by the traditional planting rules of USDA's Farm Service Agency (FSA), the administrative agency for agricultural commodity programs. These statutory fruit and vegetable planting restrictions were enacted in 1990 to address the produce sector's concerns that payments to farms with base acres planted to fruits and vegetables could lead to significantly lower prices, which would be unfair to a sector that received relatively modest Government support. In contrast, PTPP permits producers to reduce base acres and plant fruits and vegetables with a resulting acre-for-acre loss of farm commodity payments; these producers would, without PTPP, face a higher penalty.

We examined the processing cucumber market because pickling cucumbers are grown in six of the seven Upper Midwestern States eligible for PTPP. One of these States—Michigan—is the Nation's largest pickle producer, for which processing cucumbers are primarily intended. Together, these six States account for 47 percent of domestic pickling cucumber production. Similar to the markets for other processing vegetables, the market for pickling cucumbers has declined moderately, averaging 591,000 tons over the last two decades nationwide and falling from a peak of 654,000 tons in 1990 to 543,000 tons in 2009 (USDA, National Agricultural Statistics Service, 2009). Per capita consumption of pickling cucumbers has also declined from an average of 5.6 pounds (farm-weight) in the 1970s and 1980s to 4.6 pounds in the 1990s and 4.2 pounds in the current decade (USDA, Economic Research Service, 2009).

Taking advantage of farm-level planting and program participation data from FSA, we tracked farm-level production and farm program participation.¹ These data also identified individual farms' vegetable acreage and the availability of base acres, enabling us to conduct a detailed evaluation of planting constraints, the impact of increased planting flexibility under PTPP, and limits on actual planting decisions within the seven Upper Midwestern States. Using these data, we examined how potentially new and existing processing cucumber growers will respond to PTPP. Legislators might then better understand the influence of this policy lever on acreage outcomes, as well as its ultimate impact on the market for cucumbers and other fruits and vegetables.

¹Studies prior to PTPP that examined the impact of eliminating planting restrictions relied on highly aggregated State-level data and pointed to varying outcomes (Althoff and Gray, 2004; Johnson et al., 2006; Thornsby et al., 2007; and Informa Economics, 2007).

Who Is Affected by Planting Flexibility?

Under the 2008 Farm Act, recipients of funds from the Direct and Countercyclical Payment (DCP) Program and Average Crop Revenue Election (ACRE) Program can plant whatever they like on their base acres except for fruits, vegetables, and wild rice.² More specifically, DCP and ACRE payments are partially or fully forfeited each year when fruits and vegetables are planted on base acres. PTPP, however, opens the door for market conditions to play a more prominent role in farmers' crop selection and acreage decisions. To show how PTPP works, table 1 summarizes the options facing a PTPP participant compared with a producer prior to 2009.

Both before and after PTPP, farms can expand fruit and vegetable acreage on nonbase acres without losing DCP/ACRE payments. Farm program rules permit fruits and vegetables to be grown on base acreage if the farm has a history of planting fruits and vegetables. PTPP confers similar privileges to participants as those realized by DCP/ACRE participants with a history of planting fruits and vegetables—namely, a 1-for-1 reduction in payments for each base acre of vegetables planted annually. Without PTPP, farms with no planting history would receive a higher penalty. The appendix presents a detailed discussion of the factors that can affect payments.

Conceptually, relaxing planting restrictions through PTPP could expand the supply of processing vegetables. In practice, however, any supply response is likely to be small. First, many farms that grow program and horticultural crops have already established planting history and are unaffected by the current restrictions. Second, PTPP permits no more than 75,000 base acres to be added as nonbase and planted to processing vegetables for the entire Upper Midwest area. This allowable increase amounts to only a 14.1-percent share of processing vegetable plantings in those seven States.³

²Tree nuts are included in this restriction. However, lentils, mung beans, and dry peas are excluded.

³Processing cucumbers, green peas, snap beans, sweet corn, and tomatoes accounted for 532,700 planted acres according to available data for 2009 from USDA's National Agricultural Statistics Service for Midwestern States.

Table 1

Farm planting options before and after PTPP

Planting history	Before PTPP		After PTPP	
	Plant on nonbase acres	Plant on base acres	Plant on nonbase acres	Reduced base acres
<i>With</i> fruit and vegetable history		Acre-for-acre payment loss		
<i>Without</i> fruit and vegetable history	No loss of payment	Minimum of: (1) Acre-for-acre payment loss plus market value of vegetables; or (2) Entire DCP payment	No loss of payment	Payment made on reduced base acres

PTPP=Planting Transferability Payment Program.
DCP=Direct and Countercyclical Payment Program.

Source: USDA, Economic Research Service.

Perhaps more importantly, various factors—demand-side constraints limiting growth, agronomic constraints, labor availability, and startup costs for specialized equipment—may dissuade growers from entering or expanding vegetable production. Most vegetables destined for processing are grown under contract, and farmers participating in PTPP must demonstrate that they have a marketing contract for the product prior to enrollment (USDA, Farm Service Agency). Processors are aware that longrun demand in the United States is stagnant or declining and that, before they contract with new producers for acreage or for expanded acreage with existing producers, they must locate, develop, and secure market outlets—which can be difficult.

An operator may enter into a new contract with a processor because he or she perceives that doing so will increase net returns; and PTPP provides the flexibility to do so, particularly for those without a history of planting processing vegetables. Some growers may perceive that they could accrue higher net returns because of the comparative advantage of their land (particularly if it is sandy, well-drained soil) and if they already own irrigation equipment (USDA, Farm Service Agency, October 2010). Alternatively, some growers may want to diversify their crops to reduce their risk or to grow vegetables as part of a crop rotation system to mitigate pests and diseases (USDA, Farm Service Agency, October 2010).

Few payment recipients enrolled in PTPP in 2009 and 2010. FSA reports that 155 farms reported planting 10,215 acres under PTPP in 2009, 13.6 percent of the 75,000 allowable acres by statute (table 2). The data indicate that 5 fewer farms participated in 2010 than in 2009, with 43 farms participating across both years. At this point, we cannot determine whether additional acres under the pilot program will be planted in subsequent years.

Table 2
**Planting Transferability Pilot Program (PTPP)
 allowable acreage and use, 2009**

States	Base acres allowed under PTPP	Base acres actually planted	Share of allowable base acres used
Illinois	9,000	1,921	21.3
Indiana	9,000	2,567	28.5
Iowa	1,000	113	11.3
Michigan	9,000	572	6.4
Minnesota	34,000	4,273	12.6
Ohio	4,000	274	6.9
Wisconsin	9,000	495	5.5
Total Midwest region	75,000	10,215	13.6

Note: PTPP covers the following processing vegetables: cucumbers, green peas, lima beans, pumpkins, snap beans, sweet corn, and tomatoes.

Source: USDA, Economic Research Service, *Vegetables and Melons Outlook*, 2009, and ERS calculations based on USDA, Farm Service Agency data.

Production of Processing Cucumbers: A Primer

Special cultivars are used for pickling cucumbers, which are not the same as the fresh cucumbers (slicers) purchased by consumers at retail outlets. In the seven Upper Midwestern States, processing cucumbers are usually seeded beginning in late May when the risk of frost has passed and temperatures exceed 68 degrees Fahrenheit (Crop Profile, 1999; Swiader et al., 2002). While cucumbers can be grown in most soil types, they must be supplied with nutrients and continuous moisture to attain favorable growth (Swiader et al., 2002). Approximately half of the pickling cucumbers grown in the Midwest are irrigated. They mature around 60 days after planting, depending on the cultivar, with harvest taking place August through October (Swiader et al., 2002; Crop Profile, 1999). Cucumbers should be pickled within 24 hours of harvest, but not before being carefully washed and trimmed (Smith, 2010). Cucumbers are usually rotated with corn, soybeans, tomatoes, or a cover crop for a minimum of 2 years to limit diseases and pests (Crop Profile, 1999; Swiader et al., 2002).

Similar to other processing vegetables, cucumbers are usually grown under contract with a briner or packer and, while contracts are written annually, long-term relationships between the grower and packer are common (Martinez, 2006). In 2008, a comparison of contracted and actual acres planted indicates that over 80 percent of the crop was under contract in the seven Upper Midwestern States. Contracts often specify the tonnage or the number of acres to be grown and the prices offered for various size cucumbers (Armbruster and Helmuth, 1981). The processor usually selects and provides the cultivar to the grower (Swiader et al., 2002). Processors also often determine the method of harvesting. For example, 95 percent of the processing acreage in Michigan is harvested by once-over mechanical methods (Swiader et al., 2002). Processors may provide the machines and operators to growers according to contract specifications (Swiader et al., 2002). In these instances, the entry costs for a new grower would be lower.

In terms of farm revenue, higher prices in recent years have helped offset a decline in pickling cucumber acreage. As shown in table 3, the farm value of pickling cucumber production nationwide reached a record \$181 million in 2009, reflecting higher 2009 prices (\$333 per ton). While prices have been trending upward since the 1990s, yield and acres harvested remained stagnant at 5.5 tons per acre and 114,000 acres until the mid-2000s, when acreage began to decrease. By 2008, acreage harvested had fallen to under 100,000 acres, reflecting a decline in supply. Contract prices increased relative to the decline in output, accounting for the increase in farm revenue. Clearly, both growers and processors would benefit from renewed consumer interest in pickles.

Producers are eligible for PTPP in four of the eight largest producing States (by area and production)—Michigan, Ohio, Wisconsin, and Indiana—which ranked first, fifth, sixth and eighth, respectively, and accounted for 44 percent of U.S. processing cucumber acreage in 2009. The acreage share held by these four Midwest States has been growing over the last two decades as the industry has slowly consolidated into areas with lower per unit costs.

Table 3

U.S. cucumbers for pickling: Area, production, and value

Year	Area harvested	Yield per acre	Production	Average price	Crop value
	<i>Acres</i>		<i>Tons</i>		<i>\$ thousands</i>
1990	115,490	5.66	653,480	209	136,313
1995	117,090	5.22	611,180	222	135,933
2000	104,710	5.86	613,160	269	164,956
2001	108,260	5.37	581,540	291	168,958
2002	117,800	5.26	619,310	273	169,006
2003	118,800	5.46	648,430	275	178,328
2004	113,500	5.23	593,880	269	159,643
2005	110,500	4.89	540,080	256	138,391
2006	103,000	4.90	505,190	305	153,968
2007	101,500	5.33	541,230	325	175,822
2008	96,600	5.87	567,100	316	178,998
2009	97,500	5.57	542,600	333	180,845

Source: USDA, Economic Research Service, *Vegetables and Melons Yearbook*, 2009.

Other areas of significant growth include North and South Carolina, Florida, and Texas, which harvest counter-seasonally to the Midwest as cucumbers are a warm-season crop with an ideal growing temperature of 82 degrees (Swiader et al., 2002). For the 2009 crop, for example, Florida plantings occurred in January for a spring harvest, while Midwest States usually produced a summer/early fall crop (USDA, National Agricultural Statistics Service, 2009). Imports of pickling cucumbers from India, Mexico, Canada, and Honduras add to domestic supply and have been increasing in the last several years, peaking at a fresh-weight equivalent of 113 million pounds, or 7 percent of domestic disappearance in 2009 (USDA, Economic Research Service, 2009). Processors have been interested in augmenting domestic supply with imports to achieve a greater consistency in product that is often demanded by mass merchandisers.

According to FSA data, 323 farms harvested 28,766 acres of processing cucumbers in 2009 in the seven Upper Midwestern States (table 4).⁴ These farms controlled 143,448 acres, of which 69,041 acres were allocated to program crops, predominantly corn and soybeans. These farms also apportioned another 16,710 acres to other processing vegetables—including crops not covered by PTPP—such as potatoes. These data, combined with other FSA information, indicate that the majority of acres allocated to fruits and vegetables (57,078 acres) on these farms were for processing vegetables.

Over the period 2002-09, the number of FSA farms producing cucumbers for processing in the seven Upper Midwestern States decreased, while average per-farm acreage expanded. In 2009, 323 farms averaged about 89 acres planted to cucumbers, while in 2002, 503 farms planted about 63 acres each (fig. 1). The three States with the largest number of cucumber-producing farms—Michigan, Wisconsin, and Ohio—all experienced a decline in farm numbers.

⁴National Agricultural Statistics Service's 2007 Census of Agriculture indicates that 198 farms harvesting 45,700 acres of cucumbers for processing in these seven States. The FSA count differs from the census for two reasons. First, FSA uses a smaller administrative unit to define a farm (see box, "What Is a Farm Under the Farm Service Agency Definition?"), suggesting that the number of FSA farms relative to census estimates would be larger. Second, the census is comprehensive in counting farms relative to FSA farms, which are limited to those participating in Government programs.

Table 4

Farm Service Agency farms producing processing cucumbers in the seven Upper Midwestern States, 2009

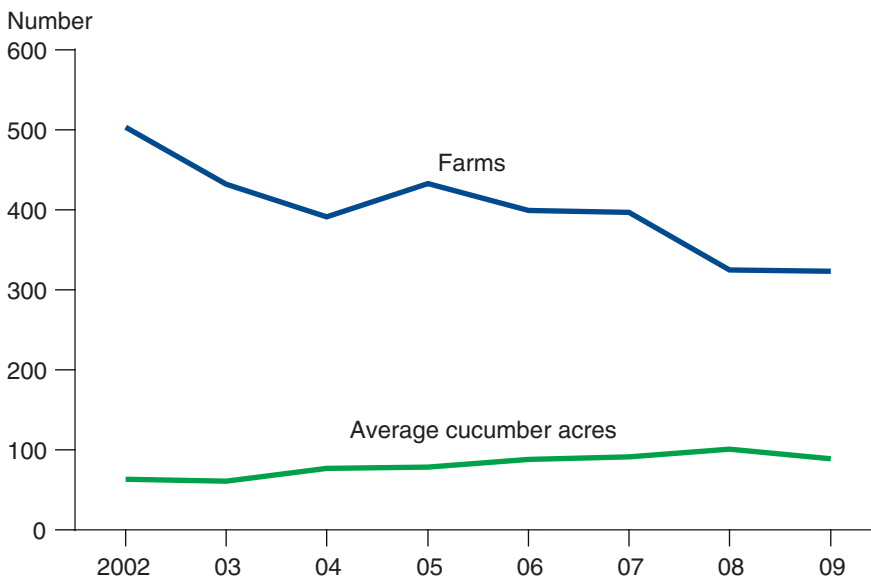
Crop allocation	Number of farms and area
	<i>Number</i>
Number of farms	323
	<i>Acres</i>
Total acres	143,448
Program crops	69,041
Fruit and vegetables:	57,078
Processing cucumbers	28,766
Other pilot program processing vegetables	10,320
Processing potatoes	6,390
Other fruit and vegetables	11,603
CRP, trees, and grass	8,832
Other nonrestricted crops	8,497
Total	143,448
Base	83,565
Nonbase	51,051
CRP, trees, and grass	8,832

CRP=Conservation Reserve Program.

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Figure 1

Farms and acreage in cucumbers for processing in the seven Upper Midwest States



Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Acreage allocated to large cucumber operations has increased over 2002-09. Seventy percent of processing cucumber acres harvested in the seven Upper Midwestern States came from 22 percent of FSA farms in 2009. These farms each apportioned at least 100 acres to processing cucumbers (tables 5). Additionally, the number of farms planting over 500 acres increased from 6 to 8 over 2002-09, accounting for 17 percent of cucumber acres harvested in 2009.

Are cucumber growers losing payments as a result of planting restrictions? To find out, we separated acreage on FSA farms that harvest processing cucumbers into base acres, nonbase acres, and environmental land (conservation reserve, grass, and trees) (see table 4). Base acres accounted for 83,565 acres and nonbase acres accounted for 51,051 acres of the total 143,500 acres on farms planting cucumbers in the seven PTPP States in 2009.⁵ Nonbase acres were primarily allocated to vegetables and, to a lesser extent, sugar beets. Since the acres designated to fruits and vegetables (57,000 acres) exceeded nonbase acres, some farms must have incurred a reduction in DCP (or ACRE) payments. For those farms with a history of planting fruits and vegetables, the loss was calculated acre-for-acre for each base acre planted to fruits and vegetables.

Sixty-three percent of farms that produced cucumbers (202 farms) in 2009 incurred an average payment reduction of \$190,600, or slightly less than \$950 per farm.⁶ For these farms, the profit-maximizing decision to forgo payments may reflect the expected net returns for planting restricted crops relative to the expected net return for planting corn or soybeans (or an alternative crop) plus the Government payment at the margin. As mentioned earlier, other growers may opt to plant pickling cucumbers because they want to diversify their crops to reduce risk or they may want to grow vegetables as part of a crop rotation system to mitigate pests and diseases.

Apart from planting cucumbers on nonbase acres, farms looking to expand production without losing payments can rent or purchase land from neighboring operations. For example, in Bay County, MI (the largest cucumber growing county in 2009), only 11 percent of cropland was farmed by processing cucumber growers. Growers can acquire nonbase acres or land with planting history by leasing or purchasing from other farms with limited or no payment reductions. Bay County cucumber growers controlled over 6,900 nonbase acres, of which 6,100 acres were allocated to fruits and vegetables. Meanwhile, FSA producers in Bay County operated 43,100 nonbase acres, of which 23,200 were allocated to fruits and vegetables. A grower's

⁵In reviewing the FSA data, we found that 22 farms indicated that they had more base acres than total acres. We adjusted the estimate downward for base acres so they would not exceed total acres.

⁶We assume implicitly that 202 farms have vegetable history (63 percent); otherwise, their payment losses would be more substantial. We derived the \$190,600 by calculating the number of restricted (fruit and vegetable) acres exceeding nonbase acres (nearly 15,300) for the 202 farms and assumed an average of \$12.46 per acre payment forgone (average DCP payment per acre for soybean and wheat base for these farms). The remaining cucumber farms (121) had more nonbase acres than fruit and vegetable acreage.

Table 5
Size distribution of farms harvesting cucumbers for processing in the seven Upper Midwestern States, 2009

Size of cucumber farms	Farms	Share of total farms	Share of total acres
	<i>Number</i>	<i>-----Percent-----</i>	
Less than 10 acres	33	10.2	0.4
10-49 acres	145	44.9	18.1
50-99 acres	73	22.6	15.5
100 acres or more	72	22.3	65.9

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

ability to acquire additional acreage suggests that, while nonbase acreage among cucumber growers is limited (800 nonbase acres), substantially more nonbase acres are available within the county (19,900 acres). The availability of nonbase acres might explain why farms reconstituted⁷ over the last several years to obtain nonbase acres and avoid reductions in Government payments. In fact, over 95 percent of the Bay County cucumber growers enrolled in FSA programs reconstituted over the 2002-09 period.

⁷Operators can “reconstitute” a farm for FSA purposes to account for changing landlord/tenant relationships, to reflect the purchase of additional land, or to address other issues. In such cases, FSA assigns a new farm number, even though the farm operator may or may not have changed.

What Is a Farm Under the Farm Service Agency Definition?¹

Many agricultural producers farm a combination of owned and rented land. Together, the combinations comprise the total “farm operation” or what is referred to as the “farm” in USDA’s Agricultural Census. Economic Research Service estimates that 844,000 farms (38 percent of all census farms) received Government payments in 2008.

Land is frequently rented from multiple landowners. If all ownership combinations were combined into a single unit, it would be impossible administratively to track program parameters and ascertain payment attribution given the changing nature of landowner-tenant relationships over time. USDA’s Farm Service Agency maintains farm records based on smaller administrative units (farms) consisting of varying groups of owners and operators. Records are maintained for over 2.2 million administrative farm units. A farmer may operate on a number of “FSA farms.” For example, Farmer Jones farms 380 acres of land on three FSA farms:

- Farm A consists of 75 acres of land share leased by Farmer Jones but owned by brothers Bill and Jim Smith.
- Farm B consists of 50 acres owned by Farmer Jones, 25 acres share leased from Mrs. Applebee, and 30 acres share leased from John Applebee, Mrs. Applebee’s son.
- Farm C consists of 200 acres of land owned by Farmer Jones.

Each farm must be enrolled separately with FSA. When electing and annually enrolling in the Direct and Countercyclical Payment (DCP) Program or Average Crop Revenue Election (ACRE) Program, farm operators, such as Farmer Jones, must treat each farm separately, enrolling one farm but not necessarily the other farms. All owners, operators, landlords, tenants, and sharecroppers must agree in writing to participate in the commodity programs. Thus, it is likely that some farmers will not enroll their entire farm operation. Farmers who elect DCP for some farms and ACRE for others are able to diversify their farm program portfolio. More details are available in USDA’s *Farm Service Agency Handbook*.

¹Adapted from Andrea Woolverton and Ed Young, *Factors Influencing ACRE Program Enrollment*, USDA, Economic Research Service, ERR-94, December 2009.

Quantifying the Role of Farm Policy

So far, our discussion has focused on the current state of the processing cucumber industry. In this section, we investigate how PTPP may affect cucumber plantings. PTPP was designed to reveal how producers would react if given the chance to grow processing vegetables on their base acres without incurring penalties. When an operator signs up for PTPP, base acres allocated to processing vegetables are reduced and added to nonbase acres. Thus, the real measure of PTPP's potential impact is captured in the additional nonbase acreage at each farmer's disposal. To analyze the impact of PTPP, we used a farm's planting history and its available nonbase acres as proxies for constraints that the PTPP was intended to relax.

Data

The FSA dataset for the seven Upper Midwestern States contains nearly a million farm-level observations for 2009 (fig. 2). The vast majority of these farms did not report acres planted in cucumbers. Cucumber production, however, tended to occur in geographic clusters because of agroclimatic similarities, information sharing among neighboring producers, and proximity to vegetable processors. Thus, we limited our total sample to just those FSA farms that belonged to the 45 counties in 2009 that had at least 1 planted acre of cucumbers destined for processing. Of the 52,060 farms in these counties, 281 actually grew cucumbers for processing.⁸

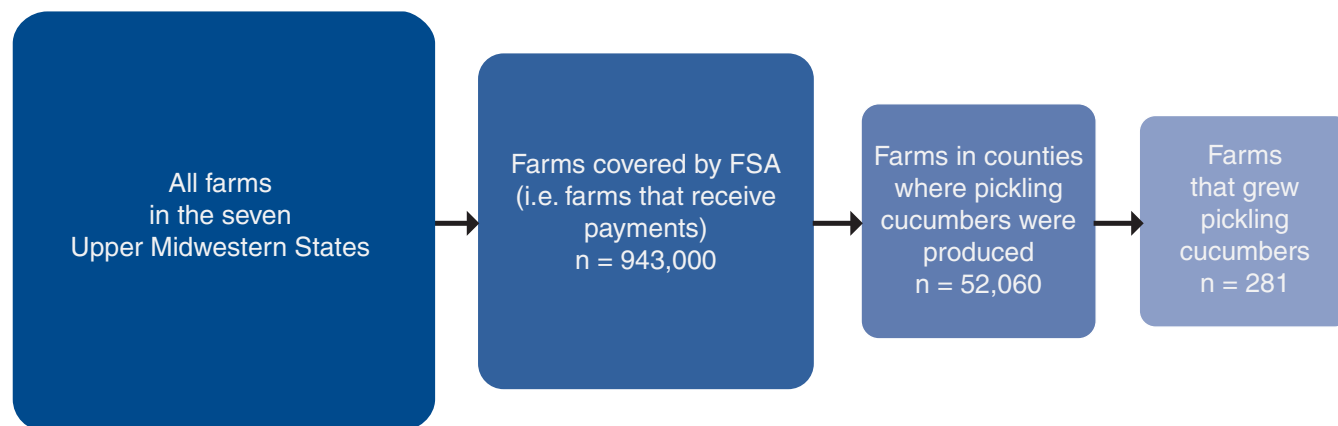
Planting History and Nonbase Acres

Under current law, farms with a history of planting fruits and vegetables forego payments on base acres planted to fruits and vegetables on an acre-

⁸The data used for the econometric analysis are a subset of the FSA farms described earlier. We used this data because we could not identify the locations of all the FSA-surveyed farms for the purpose of calculating distances to processors. Thus, our quantitative analysis focuses on 281 farms rather than 323 farms growing cucumbers for processing.

Figure 2

Composition of farm sample



FSA=Farm Service Agency.

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

for-acre basis.⁹ For farmers without planting history, however, the amount lost is much greater: Planting just 1 acre of cucumbers on base acres can cause a grower to lose as much as their entire DCP or ACRE Government payment. Few, if any, profit-maximizing farmers without planting history would likely jeopardize their total annual program payments to grow cucumbers. For this reason, producers would confine any acres in cucumbers to the farm’s nonbase area (or by renting or buying additional land). If the area (base or nonbase) available to farmers increases through renting or buying additional land, then the farm can plant program or nonprogram crops on that acreage. Of the 281 cucumber producers in our sample, we estimated at least 65 percent had farm history in planting vegetables.¹⁰

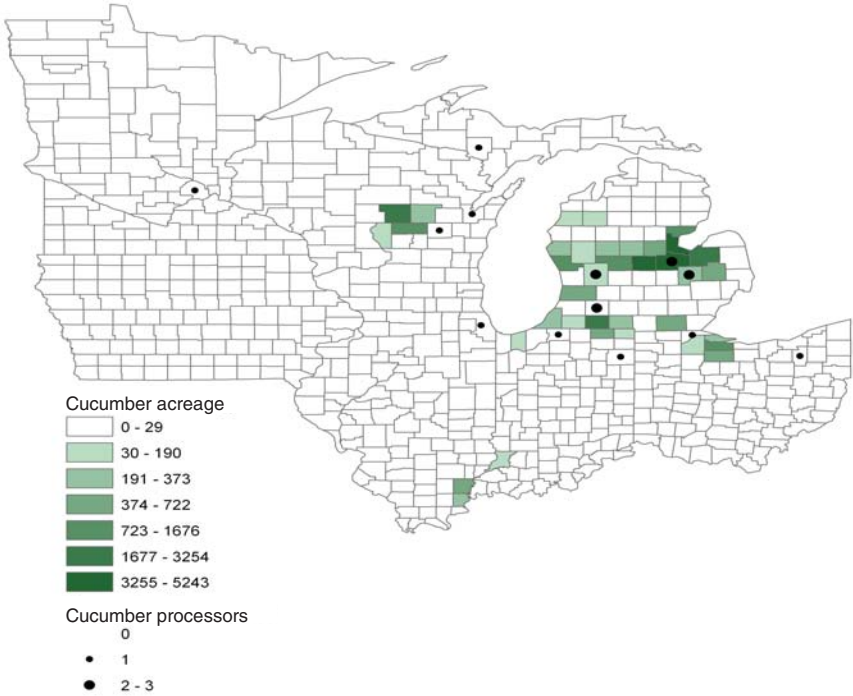
Distance to Processors

Since the pilot program pertains to vegetables destined for processing, an additional factor underlying vegetable acreage is the cost of shipping harvested vegetables to processors. Profit-maximizing vegetable growers will choose to grow within a radius of processors that ensures their profits will not be negatively impacted. Thus, we account for the distance between each FSA farm and its nearest vegetable-specific processor. Figure 3 illustrates the spatial distribution of cucumber acreage relative to processor locations. Forty-five counties grow pickling cucumbers in the seven Upper Midwestern States eligible for PTPP, with the largest share across central Michigan and central Wisconsin. Four counties in east central Michigan (Gratiot, Bay, Saginaw, and Tuscola) and Portage County in central Wisconsin host the largest acreage (table 6).

⁹Planting history is not reported in the FSA data used for this analysis. For this reason, we resort to an inference of vegetable planting history based on the planting behavior of FSA farms. Any FSA farm observed to plant *more* acres in vegetables than the number of nonbase acres on that farm is judged to have farm planting history, since otherwise, the farm might have to forego its entire program payment, an extreme and unlikely decision. From the sample of 52,060 FSA farms, about 30 percent of the farms were inferred to have farm planting history.

¹⁰Other FSA farms also may have vegetable history but choose not to plant processing vegetables beyond their nonbase acreage. Thus, the 65 percent estimate may be an understatement.

Figure 3
Cucumber acreage and processor location, by county, 2009



Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Table 6

Major cucumber producing counties in the PTPP area, 2009

State	County	Area planted <i>Acres</i>
Indiana	LaPorte	1,169
Michigan	Allegan	955
	Arenac	1,021
	Bay	3,918
	Gratiot	2,289
	Midland	715
	Montcalm	991
	Saginaw	3,667
	St. Joseph	2,989
	Tuscola	2,140
Ohio	Sandusky	874
Wisconsin	Portage	2,618
	Waupaca	580
	Waushara	501

PTPP= Planting Transferability Pilot Program.

Note: Only counties with more than 500 acres are listed.

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Throughout the region, 18 firms predominantly located in Saginaw, Kalamazoo, and Kent counties commercially process cucumbers.¹¹ Key processors include Bay Valley Foods, ConAgra Foods, Freestone Pickle Company, Gielow Pickle Company, Hausback Pickle Company, Heinz North American, Kraft Foods-Claussen Pickle Company, and Pinnacle Foods Company. Because of the specialized equipment required, most cucumber processors focus mainly on pickling facilities. We estimated that an FSA farm growing pickling cucumbers is 41 miles, on average, away from the nearest processor. The average distance to the nearest cucumber processor across all FSA farms in the 45 counties evaluated is about 64 miles. Although transportation is costly, particularly for longer hauls, Midwest processors may contract counter-seasonally with growers in other States, such as North Carolina, to operate efficiently year round.

Additional Important Factors

In addition to the three variables discussed thus far—nonbase acres, planting history, and distance to a processor—we also included a control for a farm’s planting experience (defined as cucumber plantings in the previous year, or in this case 2008). The idea is that recent cucumber planting experience reduces the informational and technical barriers a first-time farmer would otherwise face. An additional variable—a farm’s total size—captured the effect of scale economies on cucumber production. Defined as the sum of its base and nonbase acres (equivalent to total planted acres), farm size is believed to reflect the commercial and managerial attributes of the producer, which are relevant factors in predicting the number of acres planted in cucumbers.¹²

¹¹The number and location of processors came from Judge’s North American Food Processors database and Pickle Packers International. These data sources may not be comprehensive.

¹²Note that the Farm Service Agency maintains records based on administrative units (an FSA farm) consisting of varying groups of owners and operators. A farmer or other qualifying entity may operate one or several FSA farms and thus our size variable may not fully capture scale economies. See box, “What Is a Farm Under the Farm Service Agency Definition?” for more details on an FSA farm.

Finally, we added State-level controls to capture the array of State-specific effects (e.g., policy, climate) that were unobservable.

Analysis and Results

As discussed previously, PTPP permits farms to reduce base acres and plant processing vegetables on those acres, which essentially adds nonbase acres to the farm for the participating year. For this reason, we relied on a farms' nonbase acreage to proxy for the role of PTPP and posed two questions:

1. Does the extra nonbase acreage attract new farms into pickling cucumber production?
2. Does the extra nonbase acreage translate into more cucumber acreage for farms already producing cucumbers?

Our research indicated that the answer to both questions is “yes.” An additional 1-percent increase in the availability of nonbase acreage (approximately 10,000 acres) added to about half an average-sized cucumber farm, or about 43 acres. For farms that already produce cucumbers, an extra 1 percent of nonbase acreage was associated with an additional 137 total acres across the region. In other words, an extra 1-percent availability in nonbase acreage might add about 180 acres of cucumbers in the seven Upper Midwest States.

To provide more detail, we concentrated our analysis on two types of outcomes:

1. Whether or not farms grow cucumbers; and
2. If they do, the number of cucumber acres they expected to plant.

We hypothesized that the effect of nonbase acres on both outcomes was greater for farms without vegetable farm history than those with; the implication being that without the pilot program, farmers may be constrained from fully reacting to market signals. To capture the varying responses across farms with and without history, we included a farm history indicator plus an interaction term between farm history and nonbase acreage. Farms with history were assigned the value 1. Thus, the effect of nonbase acreage for farms with history was the difference between the estimated coefficients on nonbase acres and the interaction term.

For the first outcome of interest—whether farms grow cucumbers—we built a simple farm-level econometric model. This dichotomous response was modeled using a simple logit maximum likelihood framework. We estimated the model over the entire set of FSA farms in the 45 counties where pickling cucumbers are grown (52,060 observations) to generate predictions for yes/no processing cucumber plantings. Note that this sample included producers of all crops in these 45 counties, the vast majority of which did not cultivate vegetables, much less cucumbers. Table 7 presents summary statistics of the variables used in the analysis.

Table 7

Summary statistics for all producers in process-cucumber-producing counties, n=52,060

Variable	Mean	Standard deviation
Cucumber planting (0/1 indicator)	0.005	0.073
Nonbase acres	18.9	89.6
Total acres	109.84	208.4
Distance to processor (miles)	64.6	58.7
Vegetable experience (0/1 indicator)	0.004	0.06
Planting history (0/1 indicator)	0.003	0.06

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

The formal model appears as follows:

$$plant_{ij} = \beta_0 + \beta_1 nba_{ij} + \beta_2 size_{ij} + \beta_3 distance_{ij} + \beta_4 vegexp + \beta_5 history_{ij} + \beta_6 history_{ij} \cdot nba_{ij} + \delta_j + \epsilon_i$$

Plant is an indicator variable that takes the value 1 if the farm was observed to plant cucumbers and zero otherwise. The variable *nba* is the log of the nonbase acreage on the farm; *size* is the total number of acres on the farm; *distance* is the log distance from the farm to the nearest vegetable processor; *vegexp* is an indicator that takes the value 1 if the farm planted cucumbers in 2008; and *history* is an indicator that takes the value 1 if the farm is inferred to have a planting history in fruits and vegetables. Farm history is established if fruits and vegetables were planted on base acres in any year between 1998 and 2001.¹³ A dummy term δ is also included to capture unobservable effects (e.g., policy or economic characteristics) that operate at the State level. ϵ is an independently, normally distributed error term. Subscripts *i* and *j* identify the farm and the Midwestern State to which it belongs, respectively. Table 8 presents the average marginal effects from the logit regression.

A key result indicates that an extra 1-percent increase in available nonbase acres to a farm without history raises the average probability of cucumber farming by 0.002 percentage points. Applying this increase to the number of cucumber farms in the total sample implies that about 0.56 (281 x 0.002) new farms existed in the region. Also, note that the additional nonbase acres had no effect on farms with history (coefficient on log nonbase acres (0.002) plus coefficient on planting history x log nonbase acres (-0.002)), as anticipated. Since the average cucumber farm had 87 acres in cucumbers, we concluded that a 1-percent increase in nonbase acres would add about 43 extra acres into processing cucumber production for the entire 45-county region in question.

In the second model, we confined our analysis to the subset of farms that were observed to actually plant cucumbers and estimated the same variables' effects, using ordinary least squares regression, on the number of acres planted to cucumbers. Table 9 presents the summary statistics of this smaller sample of farms, and table 10 presents the results from the regression.

¹³Farm history can also be established if the farm had a history of such plantings under production flexibility contracts in the 1996 Farm Act.

Table 8

Average marginal effects from logit estimation for the decision to plant cucumbers, n=52,060, pseudo R²=0.80

Variable	Marginal effect	Standard error	p-value
Log nonbase acres	0.002	0.0003	0.000
Log total acres	-0.001	0.0003	0.035
Log distance	-0.0004	0.0003	0.098
Vegetable experience	0.006	0.0006	0.000
Planting history	0.021	0.003	0.000
Planting history · log nonbase acres	-0.002	0.0004	0.000

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Table 9

Summary statistics for all cucumber producers, n=281

Variable	Mean	Standard deviation
Cucumber acres	87.2	129.6
Nonbase acres	176.9	454.5
Total acres	455.8	810.7
Distance to processor (miles)	41.6	48.0
Vegetable experience (0/1 dummy)	0.40	0.49
Planting history (0/1 dummy)	0.66	0.47

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

Table 10

Marginal effects from OLS estimation of acres planted in cucumbers, n=281, R²=0.49

Variable	Marginal effect	Standard error	p-value
Log nonbase acres	0.543	0.117	0.000
Log total acres	0.499	0.069	0.000
Log distance	-0.539	0.130	0.000
Vegetable experience	0.309	0.141	0.029
Planting history	3.103	0.542	0.000
Planting history · log nonbase acres	-0.524	0.112	0.000

OLS=Ordinary least squares.

Source: USDA, Economic Research Service calculations based on Farm Service Agency data.

The results suggest that a 1-percent increase in nonbase acres raises the number of acres planted on farms already growing cucumbers without history by 0.543 percent and those with history by 0.019 (coefficient on log nonbase acres (0.543) plus coefficient on planting history x log nonbase acres (-0.521)). Given the average per farm area in cucumbers (87 acres), this implies an average per farm increase of 0.489 acres. Multiplying this per-farm increase by the total number of cucumber farms yields an extra 137 extra acres (0.489 acres/farm x 281 farms) in cucumbers. Counting the acres from new farms that enter cucumber production (43 acres), the total number of acres brought into production climbs to 180. Of the 45-county area processing cucumbers examined here, this represents a total acreage response of about 1 percent. In short, a 1-percent rise in nonbase acreage translates into a 1-percent increase in cucumber acreage.

In addition, producers who were closer to processors planted more cucumber acres than those more distant; having cucumber planting experience was strongly correlated to continued acreage planted to cucumbers. For farms already producing cucumbers, the larger the farm (across all crops), the more acres planted in cucumbers (e.g., there is a positive farm scale effect).

Conclusions

We addressed the possible effects of the Planting Transferability Pilot Program (PTPP) on the cucumber-processing market. The 2008 Farm Act established the flexibility program so that growers could increase their plantings and offer more product to processors and, ultimately, to consumers. This study is the first to address the acreage response of farmers with respect to a particular vegetable—in this case, cucumbers for processing—and to employ farm-level data to reflect acreage decisions across a wide swath of planting and land-use choices.

We examined two key variables that influenced a farmer's decision to plant cucumbers—a farm's vegetable planting history and the availability of nonbase acres. These variables essentially reflect the constraints that PTPP aims to relax. From our analysis, we concluded that a 1-percent rise in nonbase acreage at the farm level translates into a 1-percent increase in cucumber acreage for the seven Upper Midwestern States evaluated. We found that between the added new farms and the added acres on existing farms, a 1-percent expansion in flexible acreage could account for about 180 acres in cucumbers.

From these results, the longrun outcomes associated with the PTPP seem subjective. On one hand, for the bulk of producers in the region who ordinarily plant program crops, the impact of the PTPP was extremely modest. Most Midwestern farms cannot be expected to react in any significant way to the relaxation of planting restrictions on their base acres. Consequently, we would anticipate very little or no national market and price effect since the production changes implied by PTPP were small. For the handful of farms that do produce cucumbers, however, the planting restrictions apparently did matter and, relative to the current cucumber acreage planted, the number of new acres was expected to rise, although modestly.

For policymakers interested in how restrictions on fruit and vegetable planting at the national level might constrain overall supply, our cucumber-specific results point toward a minor but detectable effect. Additional examination of overall fruit and vegetable production—both fresh and processing—as well as a widened geographic scope of analysis, may open the door to broader conclusions.

Our analysis suggests that farmers' response to relaxing the planting restrictions depends on both demand- and supply-side factors and program specifications. In the case of processing vegetables, processors will not enter into contracts with growers unless they foresee consumer interest in the product and higher net returns relative to other cropping alternatives. In addition, high costs related to specialized equipment, expertise, harvest labor, and agronomic constraints may dissuade producers from entering the fruit and vegetable farm sector.

Lastly, program rules are not always binding. As illustrated in this report, farmers can expand fruit and vegetable acreage on nonbase acres without losing Government payments. If nonbase cropland is not available within the farming operation, the farmer can increase or purchase nonbase cropland and reconstitute to include the new acreage, again without incurring a payment reduction. Farm program rules permit fruits and vegetables to be grown on base acreage if the farm has a history of planting fruits and vegetables, but in these cases, payments are reduced acre-for-acre for each acre of fruits and vegetables planted. Relative to net returns, the loss of these program payments may be marginal. Thus, many growers might not find that the relaxation of planting restrictions, even within a broader geographic area (seven Midwestern States) and commodity type (processing), would alter their potential profitability calculations.

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Appendix: Farm Program Payment Reductions With and Without the Planting Transferability Pilot Program (PTPP)

The 2008 Farm Act distinguishes two types of payment recipients—farms and producers—and divides them into those with planting history and those without. For a given FSA farm, planting history is established if fruits and vegetables were planted on any of their base acres in any year between 1998 and 2001.¹⁴ For an FSA farm, history can be established by planting even just 1 acre of fruits or vegetables, regardless of the specific type, on its base acreage. In contrast, a producer's history limits planting of fruit and vegetable acreage to his or her *average annual history* of plantings to the *specific commodity*. History is based on the annual average production for the years 1991-95 or 1998-2001, as selected by the producer. For example, a producer might have history based on growing 50 acres of sweet corn and 25 acres in snap beans from 1991-95. A farm (or producer) with a history of planting fruits or vegetables would incur only an acre-for-acre reduction in DCP or ACRE payments for each base acre planted to fruits and vegetables (or a *specific* fruit or vegetable).

Farms or producers without any planting history (or producers who exceed their planting history) who opt for planting fruits and vegetables on base acres incur a more substantial penalty. The loss is either:

1. An acre-for-acre reduction in DCP or ACRE payment *plus* the market value of the fruits and vegetables planted; *or*
2. The entire DCP or ACRE payment, whichever is smaller.

To understand how the loss of payments is calculated, consider three simple numerical examples presented in appendix table 1.¹⁵ In column 1, a farm with 100 acres composed entirely of base area plants 20 acres of fruits or vegetables. In column 2, a farm with 50 base and 50 nonbase acres plants 40 acres of fruits or vegetables. In column 3, a farm with 50 base and 50 nonbase acres plants 60 acres of fruits or vegetables.

Under the acreage scenario described in column 1, consider the policy scenario in which the farm has fruit and vegetable history (row 1). In this case, the farm would forgo DCP/ACRE payments on the 20 acres planted to fruits and vegetables. The penalty becomes more stringent for producers with limited history (row 2) and farms or producers without history (row 3). For a producer with 10 acres of fruit and vegetable history, the total payment is reduced by the lesser of: (1) the entire DCP/ACRE payment; or (2) the DCP/ACRE payment on the 10 base acres (the difference between the 20 acres planted on base acres and the history of planting fruits and vegetables on 10 base acres) plus the market value of the fruit or vegetable. For those farms or producers *without* fruit or vegetable history, the total payment would be reduced by the lesser of: (1) the DCP/ACRE payment on the 20 base acres and the market value of the fruit or vegetable; or (2) the total DCP/ACRE payment. Participants in the pilot program, however, only lose one acre's payment for every one acre planted in processed vegetables.

¹⁴Planting history can also be established if a farm had a history of such plantings under production flexibility contracts in the 1996 Farm Act.

¹⁵*Farm Service Agency Handbook* contains detailed examples illustrating the statutory provisions.

Farm program payment reductions under various policy and farm scenarios

	Farm acreage scenarios		
Before PTPP	(1) 100 base acre farm, plant 20 acres F&V	(2) 50 base acre and 50 non-base acre farm, plant 40 acres F&V	(3) 50 base acre and 50 non-base acre farm, plant 60 acres F&V
(1) Farm with F&V planting history	DCP on the 20 acres	None	DCP on the 10 acres (planted acres minus non-base acres)
(2) Producer with F&V planting history on 10 base acres	Minimum of: (1) entire DCP; or (2) market value of F&V planted plus DCP on 10 acres (planted acres in excess of history)	None	DCP on the 10 acres (planted acres minus nonbase acres, up to producer's F&V history)
(3) Farm or producer with no F&V planting history	Minimum of: (1) entire DCP; or (2) the market value of F&V planted plus DCP on 20 acres	None	Minimum of: (1) entire DCP; or (2) market value of F&V planted plus DCP on 10 base acres (planted acres minus nonbase acres)
With PTPP			
(4) Farm with no F&V planting history	DCP on the 20 base acres reduced for PTPP participation	None	DCP on the 10 base acres reduced for PTPP participation (planted acres minus nonbase acres)
(5) Producer with F&V planting history on 10 base acres	DCP on the 20 base acres reduced for PTPP participation	None	DCP on the 10 base acres reduced for PTPP participation (planted acres minus nonbase acres)

PTPP=Planting Transferability Pilot Program.
 F&V=Fruits and vegetables.
 DCP=Direct and Countercyclical Program.

Source: USDA, Economic Research Service, based on *FSA Handbook: Direct and Counter-Cyclical Program and Average Crop Revenue Election for 2009 and Subsequent Crop Years*, 2010.

Column 2 is easier to understand. A farm or producer that plants fewer acres to fruits and vegetables relative to nonbase acres incurs no loss of payment. In contrast, in column 3, the farm or producer (up to their history) whose fruit and vegetable acreages exceeds their nonbase acres will lose DCP/ACRE payments on an acre-for-acre basis for each acre that exceeds nonbase area. For those farms or farmers that do not have history, the loss equals the DCP/ACRE payment on the 10 base acres and the market value of the fruit or vegetable, not to exceed the total DCP/ACRE payment. As in column 1, participation in PTPP effectively reduces the number of base acres that receive payments.

To solidify understanding of payments foregone, appendix table 2 compares farms that rotate planting corn and cucumbers over multiple years. Suppose a farm has 1,000 acres composed entirely of base acres on which the grower plants only corn (column 1). Since no fruits and vegetables are grown, there is no loss of payment. However, if the farm grows 980 acres of corn and 20 acres of cucumbers, the Government payment would be reduced by \$400, assuming a fruit or vegetable planting history of 20 acres and a DCP payment of \$20 per acre (column 2).

In the case of a farm or producer without fruit and vegetable history or a producer exceeding historical plantings, the payment reduction amounts to the lost DCP or ACRE payments plus the market value of the fruits or vege-

tables produced. The reduction is capped at the value of all DCP or ACRE payments for the farm, \$12,700 in the case of 10 planted cucumber acres (column 3) and \$20,000 in the case of 20 planted cucumber acres (column 4). The \$12,700 loss is calculated as the \$12,500 market value of cucumbers plus the \$200 DCP payment; the \$20,000 loss is the entire DCP payment.

Meanwhile, column 5 shows the payment reduction under PTPP at \$400. With the much smaller loss in Government payments, the grower is more likely to make a decision based on market prices and the costs of planting alternative processing vegetables. The situation for the farm with a history of planting fruits and vegetables is unchanged. Their payments are reduced by \$400, a relatively small amount, with or without PTPP.

Appendix table 2

**Farm program payment scenarios:
Trade-offs between corn and pickling cucumbers**

	Without PTPP				With PTPP
	With history		Without history		No history
	(1)	(2)	(3)	(4)	(5)
1. Cropland acres	1,000	1,000	1,000	1,000	1,000
2. Corn base acres	1,000	1,000	1,000	1,000	980
3. Corn acres	1,000	980	990	980	980
4. Cucumber acres	0	20	10	20	20
5. Direct payment (\$)	20,000	19,600	7300	0	19,600
6. Corn market value (\$)	525,000	514,500	519,750	514,500	514,500
7. Cucumber market value (\$)	0	25,000	12,500	25,000	25,000
8. Total crop value (\$ from 6+7)	525,000	539,500	532,250	539,500	539,500
9. Total revenue (\$ from 5+8)	545,000	559,100	539,550	539,500	559,100
10. Payment reduction	0	400	12,700	20,000	400

Notes: We assume a \$20 direct payment per corn base acre and no countercyclical or ACRE payment, a \$3.50 price per bushel of corn with a yield of 150 bushels per acre, and a \$250 price per ton received by growers of pickling cucumbers with a yield of 5 tons per acre. A farm would have a history if it planted fruits and vegetables on base acreage in any year from 1998 to 2001. This does not mean they are currently producing fruits or vegetables, as is the case in column 1. Column 2 assumes a fruit or vegetable history of 20 acres.

Source: USDA, Economic Research Service, based on *FSA Handbook: Direct and Counter-Cyclical Program and Average Crop Revenue Election for 2009 and Subsequent Crop Years*, 2010.