COST EFFECTIVENESS OF THE VARIABLE COST-SHARE LEVEL OPTION IN THE AGRICULTURAL CONSERVATION PROGRAM*

William M. Park

and

Steven E. Monteith**

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**Associate Professor in the Department of Agricultural Economics and Rural Sociology at the University of Tennessee and Credit Examiner with the Farm Credit Administration, respectively.

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Soil Conservation

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ABSTRACT

Counties employing the Variable Cost-Share Level option are compared with those employing uniform rate cost sharing in West Tennessee in 1984 with regard to public cost per ton of erosion reduction, type of practices applied, erosiveness of land treated, total cost per acre treated and average cost-share rate.

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Soil erosion control policy in the United States has received much criticism in recent years, with the cost effectiveness of major programs being question (USGAO). Though regulatory or tax policy approaches for gaining soil erosion control are often analyzed (Taylor and Frohberg; Boggess, et al.; Walker and Timmons; Spurlock and Clifton; Seale, et al.) and calls for mandatory soil erosion control are increasingly heard (Cook; Epp and Shortle), subsidization to induce voluntary adoption of best management practices (BMPs) appears likely to be the general policy approach for the foreseeable future (Sharp and Bromley; AAEA Task Force). Cost effectiveness in the use of public funds for subsidization is a matter of concern because these funds are limited.

Defining cost effectiveness with regard to soil erosion control has received a great deal of attention (USGAO). Ideally, cost effectiveness should be defined in terms of damages avoided, both on- and off-site. However, given the limitations on such information, cost effectiveness is defined here in terms of cost per unit reduction in the annual average erosion rate based on the Universal Soil Loss Equation (USLE).

The Agricultural Conservation Program (ACP), the primary federal effort to encourage soil erosion control, employs a cost-sharing approach for offering subsidies. Uniform cost sharing at a 50% rate was the rule until recently, regardless of the particular situation and characteristics of the farmer, the rate of erosion on the field to be treated, or the particular BMP to be applied. The ACP recently has been modified in several ways to increase cost effectiveness. These efforts came in response to documentation that in recent years the bulk of cost-sharing funds has been directed toward slight erosion problems, where cost per unit of erosion reduction is relatively high. During the period 1975-78, only 28% of cost-sharing funds were allocated for BMPs on fields eroding at greater than 10 tons per acre per year, where cost per unit of erosion reduction is relatively low (USDA, 1980a). As a result, some ACP funds are now being targeted to highly erosive watersheds and counties (Neilson). However, this does not ensure that BMPs are necessarily applied to the most highly eroding fields within these targeted areas (Park and Sawyer). To address this limitation, the Variable Cost Share Level (VCSL) option in the ACP can now be used by counties if they wish.

In the VCSL option cost-sharing rates are higher: 1) the higher the initial erosion rate for the field to be treated; 2) the greater the percentage reduction achieved in the erosion rate by the BMP to be applied; and 3) the lower the soil loss tolerance or T-value of the soil. Percentage reduction, as estimated by pre- and postpractice application of the USLE, is multiplied by the appropriate "weighting" factor in Table 1 to arrive at the cost-sharing rate. For example, terraces which reduce the erosion rate on a field with T = 5 from 12 to 6 tons per acre per year (a 50% reduction) would qualify for 40% cost sharing (50% x 0.8 = 40%). The maximum cost-share rate allowed is 75%. If the initial erosion rate is less than the T-value of the soil, no cost sharing is available. While in concept such a differential incentive structure has the potential to increase cost effectiveness by influencing the type of BMPs applied and types of fields treated, little evidence exists as to whether this has been borne out in practice. Several studies have considered the idea of varying cost-share rates on other bases (Bouwes, et al.; Johnson, et al.; Walker and Timmons). Kugler and Park and Sawyer considered how the VCSL option could be expected to work.

The objective of the study reported here was to evaluate the impact of the VCSL option on the public cost effectiveness of the ACP in the 21-county West Tennessee targeted area in 1984. This was done by comparing cost share per ton of erosion reduction for counties using the VCSL option with that for counties employing uniform cost sharing. To gain a better understanding of how the VCSL option influenced cost effectiveness, the following program characteristics were analyzed for each set of counties: 1) the distribution of cost-share funds among BMPs; 2) the distribution of BMP acreage among prepractice erosion rate classes; 3) the total cost per acre for BMPs; and 4) the average cost-share rate.

Description of the Study Area

The 21-county targeted area of West Tennessee is a region of intensive agricultural production. Soybeans are the major crop, with significant acreages of corn, cotton and wheat also being grown. The soils in the western part of the area are silty loess soils which are highly productive but also highly erosive (MLRA 134). In the eastern part of the area, soils are formed mostly of sandy or clayey coastal plain material and though less productive are also highly erosive (MLRA 133). The combination of intensive row cropping, sloping land, intensive rainfall and highly erosive soils has contributed to making the erosion problem in this 21-county area one of the worst in the country. According to the 1982 National Resources Inventory (NRI), the average erosion rate on cropland in these two MLRAs was 12.9 T/A/Y. Counties employing the

VCSL option are scattered throughout the area. Thus, soil, crop and other factors that differ across the two MLRAs or among counties were not expected to significantly influence the comparison of VCSL and counties. Even so, an attempt was made to systematically test for the possible influence of differences in the inherent erosiveness of the land in the two subsets of counties and is reported later.

Source of Data

The USDA began using the Comprehensive Reporting and Evaluation System (CRES) in all counties in fiscal year 1984. A detailed set of data for each individual BMP receiving cost sharing under the ACP is collected for the CRES, including pre- and postpractice erosion rate, T-value, number of acres, total cost and cost-share payment. The CRES data for Tennessee was obtained from the national ASCS office in computerized form.

Results

During 1984, there were 13 counties using the VCSL option in West Tennessee: Benton, Carroll, Chester, Crockett, Decatur, Gibson, Hardeman, Haywood, Henderson, Lauderdale, McNairy and Tipton. Eight counties were using uniform rate cost sharing: Fayette, Henry, Lake, Madison, Obion, Shelby and Weakley. A small amount of extra cost-sharing funds was offered to counties as an incentive to adopt the VCSL option. As a result, the VCSL counties provided $1,210,968 in cost sharing for 1,497 BMPs in 1984, while the UNIFORM counties provided $620,341 for 671 BMPs. Thus, comparisons will focus on relative percentages and averages.

Overall cost share per ton of erosion reduction was found to be 25.9% higher in VCSL counties than in UNIFORM counties. The average amortized cost share per ton was $.423 in VCSL counties and $.336 in

UNIFORM counties. This was contrary to expectations based on the logic of the differential incentive structure of the VCSL formula. Understanding why this was the case requires a careful look at a number of factors.

Distribution of Cost-Share Funds Among BMPs

Twelve BMPs accounted for nearly all cost sharing in VCSL and UNIFORM counties in West Tennessee in 1984. The names, corresponding symbols and average cost share per ton of erosion reduction in each set of counties for these BMPs are listed in Table 2. The percentage of total cost sharing expended on each of these BMPs is indicated in Figure 1. Differences in these proportions between the two sets of counties could reflect the effects of the "percentage erosion reduction" factor of the VCSL formula in encouraging or discouraging certain kinds of practices. Of the seven least cost effective BMPs in UNIFORM counties (those with cost share per ton of erosion reduction above average), four (SL1, SL4, ACR1 and WL1) received a higher percentage of total available cost sharing in VCSL counties, while three (SL2, SL8 and SL14) received a smaller percentage. Of the five most cost effective BMPs in UNIFORM counties (those with cost share per ton of erosion reduction below average), only one (SL11) received a higher percentage of total available cost sharing in VCSL counties, while the other four (SL5, SL15, WP1 and WP3) received a lower percentage. Thus, there is little evidence of a shift toward the more cost effective BMPs. In fact, just the opposite occurred to some extent.[1]

[1]Interestingly, of the seven least cost effective BMPs in the UNIFORM counties, six had lower cost share per ton in VCSL counties, while of the five most cost effective BMPs in the UNIFORM counties, four had higher cost share per ton in VCSL counties. Thus, the VCSL option apparently worked to reduce variation in cost share per ton among BMPs.

Distribution of Acreage Among Prepractice Erosion Rate Classes

The other key factor in the VCSL formula is "prepractice erosion rate" (PPER), which could be expected to increase the average PPER of land to which BMPs are applied.[2] The average PPER of fields in VCSL counties was 31.0% higher at 21.6 tons per acre per year (T/A/Y) compared to 16.5 T/A/Y for UNIFORM counties. The key related fact is that erosion reduction per acre of BMP was 53.6% higher in VCSL counties at 17.2 T/A/Y compared to 11.2 T/A/Y in UNIFORM counties. The percentage of BMP acreage within each PPER range for each set of counties is indicated in Figure 2. Most of the difference between the two groups is attributable to the higher percentages of acreage in the 0-10 T/A/Y ranges in UNIFORM counties and the higher percentages of acreage in the 10-50 T/A/Y ranges in VCSL counties. In UNIFORM counties, 48.2% of all acreage was eroding at less than 10 T/A/Y, whereas in VCSL counties, only 12.5% of the acreage was eroding at less than 10 T/A/Y. These differences between the two sets of counties were fairly consistent across all the various BMPs. Therefore, it seems that the differential incentive structure of the VCSL formula did shift BMPs toward more highly eroding fields. Based on the strong negative correlation between PPER or erosion reduction per acre and total cost per ton of erosion reduction, this shift in itself would increase cost effectiveness. Why then was cost share per ton higher in VCSL counties than in UNIFORM counties? The answer lies in differences in total cost

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[2] Attention has not yet been given to the possible influence of the T-value factor in the VCSL formula, primarily due to the expectation that lack of much variation in the T-value among soils in West Tennessee would seriously limit the influence of this factor.

per acre for BMPs and average cost-share rate between the two sets of counties.

Total Cost Per Acre of BMPs

BMP application costs and cost-share rates together determine the amount of cost sharing paid per acre. This, along with erosion reduction in tons per acre, determines cost share per ton of erosion reduction or public cost effectiveness. The average total cost per acre of BMPs for VCSL counties was $70.21, 49.3% higher than for UNIFORM counties at $47.02. This higher total cost per acre for BMPs under VCSL was due to both a higher application cost per BMP and a smaller number of acres per BMP. In looking at individual practices, the type of BMP most responsible for the difference was sediment retention structure (WP1), which accounted for 17.1% of all cost-sharing funds spent in VCSL counties. The total cost per acre of WP1 in VCSL counties was $264.09, 108% higher than the $126.67 per acre cost in UNIFORM counties, due at least in part to application on more highly eroding fields. This 49.3% higher total cost per acre of BMP in VCSL counties served to offset to a great extent the 53.6% higher erosion reduction per acre in VCSL counties. Total cost per ton of erosion was lower in VCSL counties than in UNIFORM counties, but only 10.2% lower at $.688 compared to $.766.

Cost-Share Rates

The average cost-share rate for UNIFORM counties was 43.9%. The primary reason this figure is less than 50%, the typical rate of cost sharing in UNIFORM counties, is that a $3,500 per year national limitation exists on total cost-sharing payments per person. Thus, for relatively expensive BMPs or treatment of large acreages, the effective rate is reduced. VCSL counties had an average cost-share rate of 61.5%, which was 40.1% higher than the average cost-share rate in UNIFORM counties. Given that total cost per ton was only 10.2% lower in VCSL counties, this substantially higher average cost-share rate in VCSL counties resulted in a 25.9% higher public cost per ton, as noted earlier.

In looking at the cost-share rates of individual practices, the three least cost effective BMPs, vegetative cover improvement (SL2), cropland protective cover (SL8) and water impoundment (WP1) had significantly lower than average cost-share rates in VCSL counties, but the cost-share rates for these BMPs in VCSL counties were still above the rates for the same BMPs in UNIFORM counties. This indicates that while the differential incentive structure of the VCSL formula does favor the more cost effective practices to some degree, there is still more incentive to apply even the most ineffective BMPs in VCSL counties than in UNIFORM counties.

Of interest, too, is the relationship of cost-share rate to PPER class, as indicated in Figure 3. Notice that the relationship is similar for the two sets of counties, with an increase of about 10 to 15 percentage points as PPER goes from zero to 40 T/A/Y and a slight decline thereafter. The difference is that cost-share rates in VCSL counties are roughly 10 to 20 percentage points higher throughout the range of PPER classes. Thus, while the VCSL formula gave a 15 percentage point higher cost-share rate than in UNIFORM counties for fields eroding at 30-50 T/A/Y, it also gave a 15 percentage point higher rate for fields eroding at 5-10 T/A/Y. Notice also that most of the rate differential produced by the VCSL formula occurs before 10 T/A/Y, with the cost-share rate remaining relatively constant above 10 T/A/Y. Thus, there is little more incentive in VCSL counties to apply a BMP on a field eroding at 30-50 T/A/Y than on one eroding at 10-15 T/A/Y. The slight decline in cost-share rates above 50 T/A/Y is likely because more expensive BMPs are used, with the $3,500 per farmer annual limit more often a constraining factor.

Sensitivity to Differences in Land Resource Bases

Variation in erodibility characteristics of cropland could cause variation in cost effectiveness. If cropland in VCSL counties were inherently more highly erosive than in UNIFORM counties, total cost per ton could be expected to be lower in VCSL counties apart from the influence of the VCSL formula. To test for the influence of this type of variation in cropland characteristics, information from the National Resources Inventory (NRI) was used to estimate the percentages of cropland by PPER class for UNIFORM and VCSL counties. Then, the following question was asked: If the cropland in uniform counties were distributed by PPER class in the same way as cropland in VCSL counties, how much different would total cost per ton have been in UNIFORM counties, assuming the same total cost per ton for each PPER class as was actually the case for UNIFORM counties? VCSL counties did have a slightly more highly eroding cropland base, with 24.7% eroding at greater than 15 T/A/Y compared to 23.4% in UNIFORM counties. However, total cost per ton in UNIFORM counties with the VCSL counties' cropland base would have been $.765, which is almost identical to the actual figure of $.766. Thus, the shift to higher PPER classes and lower total cost per ton in VCSL counties was apparently a function of the VCSL formula as opposed to the inherent nature of the land resource bases.

Policy Implications

The findings of this study indicate that the VCSL option was less cost effective in the use of public funds than the uniform cost-sharing approach, not because the concept is faulty, but due to higher total cost per acre of BMPs and a higher average cost-share rate in VCSL counties. The VCSL option did shift BMP application toward more highly eroding fields as expected. To improve the cost effectiveness of the VCSL option in practice, the VCSL formula could be modified in two ways. The first would be to widen the differential between the highest and lowest cost-share rates in practice to perhaps 25% to 75%. Under the current formula, even relatively cost ineffective BMPs on slightly eroding fields qualify for about 50% cost-share rates. The second would be to spread this rate differential over a wider range of PPER levels. Under the current formula, many BMPs qualify for the maximum 75% cost-share rate with a PPER of only 10-15 T/A/Y. These changes would strengthen the influence on which BMPs are applied to what kind of fields and likely reduce the average cost-share rate.

Two qualifications to these suggestions are in order. First, the limited area and time period studied suggest caution in generalizing to the regional or national level. The average erosion rate in West Tennessee is well above the national average. Different parameters may be needed to reflect conditions in different regions. Second, additional administrative costs of the VCSL option should also be considered. From a survey of local administrators, they appear to be quite small in relation to cost-share expenses.

Table 1. Weighting Factors for Percentage Erosion Reduction Form of Variable Cost Sharing in the Agricultural Conservation Program

Prepractice erosion rate (tons per acre per year)	T-value			
	T = 2	T = 3	T = 4	T = 5
20+	1.3	1.3	1.3	1.3
18+ through 20	1.3	1.3	1.3	1.2
16+ through 18	1.3	1.3	1.3	1.1
14+ through 16	1.3	1.3	1.2	1.0
12+ through 14	1.3	1.3	1.0	.9
10+ through 12	1.3	1.1	.9	.8
8+ through 10	1.3	1.0	.8	.7
6+ through 8	1.1	.8	.7	.7
4+ through 6	.9	.7	.7	.7[a]
4 or less	.7[a]	.7[a]	0	0

[a]If prepractice erosion rate is not in excess of T, the weighting factor is 0.

Source: U. S. Government Accounting Office, 1983.

Table 2. Symbols, Names and Public Cost Effectiveness of BMPs

Symbol	BMP	Cost share per ton of erosion reduction	
		UNIFORM	VCSL
SL1	Vegetative cover establishment	$ .600	$ .420
SL2	Vegetative cover improvement	3.111	1.537
SL4	Terrace systems	.617	.296
SL5	Diversions	.335	.291
SL8	Cropland protective cover (winter)	5.407	1.152
SL11	Critical area vegetative cover	.058	.484
SL14	Reduce tillage	.480	.157
SL15	No-till system	.187	.277
ACR1	Vegetative cover establishment	.466	.525
WC1	Water impoundment	2.375	.819
WP1	Sediment retention structure	.335	.609
WP3	Sod waterways	.201	.710

FIGURE 1: DISTRIBUTION OF COST-SHARE FUNDS AMONG BMPs

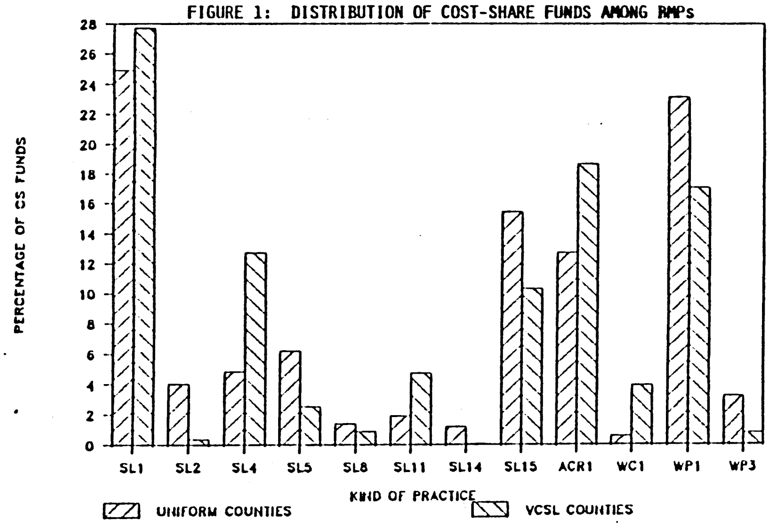


FIGURE 2: DISTRIBUTION OF BMPs AMONG PPER CLASSES

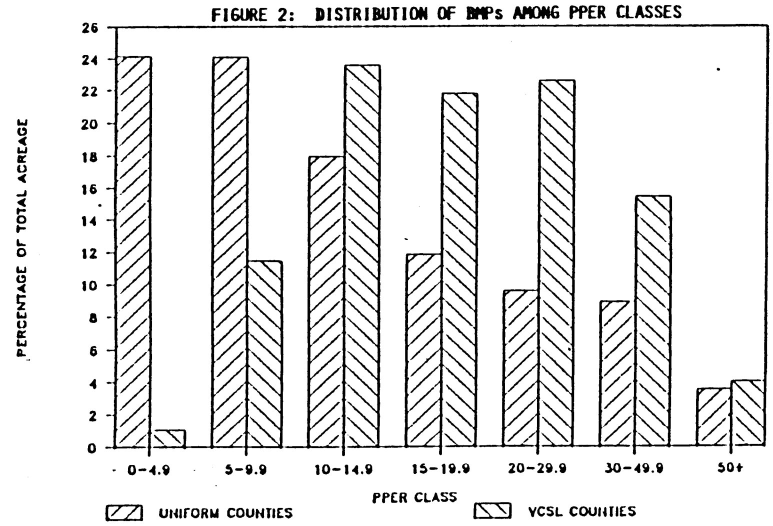
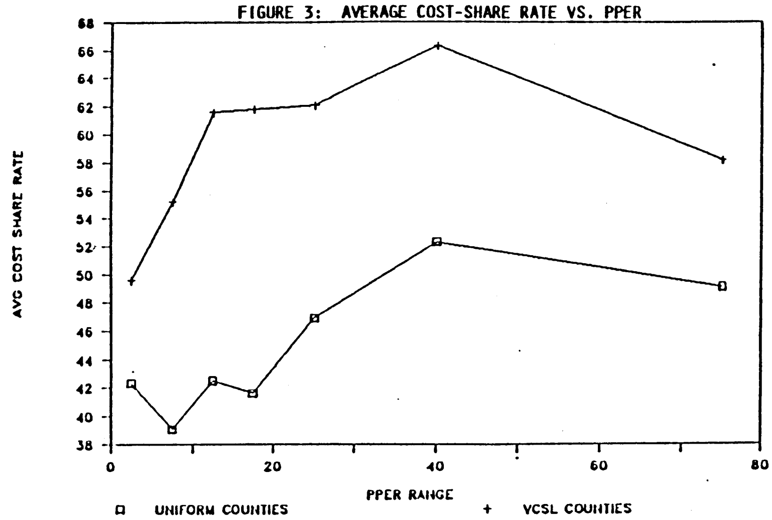


FIGURE 3: AVERAGE COST-SHARE RATE VS. PPER



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