

USE OF SENSOR-CONTROLLED PRECISION SPRAY TECHNOLOGY WITH TOWER FOR IMPROVING ORCHARD PROFITS AND REDUCING ENVIRONMENTAL IMPACTS IN WESTERN NEW YORK

Orleans County Soil & Water Conservation District

The USDA Conservation Innovation Grant, Contract Number NRCS 68-3A75-6-162 has been a successful project to educate orchard farms across NYS on today's sprayer technologies to reduce environmental concerns and to reduce operating costs. Today's farmers need to meet regulations in order to sell and export apples overseas. These technologies help farms compete in a global market by meeting EUROGAP regulations. This grant opportunity has also been a success research project, lead by Dr. Andrew Landers from Cornell University's Experiment Station. Dr. Landers' study included assessing environmental savings and the benefits in which growers can achieve with today's technologies.

Farmers from Orleans County to the State of Washington were educated on this grant program. There were 9 field demonstrations held across Orleans County for farmers and government decision makers throughout the region to observe the equipment in use. There was also an additional field demonstration at Cornell University's Experiment Station for growers across the state. These field demonstrations allowed audience members to gain valuable information from manufactures, Cornell Faculty members, and farmers. Audience members were also able to ask questions and learn which products would be most beneficial to their operation. There were several articles published across the United State concerning the grant and the study being completed by Cornell testing the effectiveness of these technologies. Several presentations were given to audiences across the nation by Dr. Landers.

The Ten Growers participating in the project witnessed a reduction in the amount of pesticides applied. From Dr. Landers study it was found that all 10 farms experienced a reduced cost associated with applying pesticides with the sensor-tower sprayers as compared to conventional sprayers. Fewer pesticides were released into the environment and pesticides were targeted onto the trees better, reducing chemical drift. The tower-sensor combination does not fit every operation's pesticide application needs. Depending on the farm's orchard type, orchard stand, and maturity level of the trees; sensors may be needed more than the tower or vice-versa. For example, sensors are beneficial when trees are large and have gaps, while a tower is more beneficial when trees have a uniform stand and very few gaps between trees. The sensor tower combination is most beneficial for orchard stands less than 12 feet in height that have gaps in between trees. Farmers need to assess orchard stand to choose the proper technology to fit the farm needs that will also reduce environmental concerns.

Traditionally, in New York State very little conservation assistance has been provided to the orchard industry to implement Best Management Practices (BMP's). Livestock operations have often been the focus of the NRCS and the NYS Soil & Water Conservation Committee to provide cost share for the implementation of BMP's to reduce environmental concerns. Decision makers of the NYS NRCS and the NYS Soil & Water Conservation Committee were present at field demonstrations and were educated on the environmental benefits of these technologies. Based on this project and outreach efforts, the NYS Soil & Water Conservation Committee has made changes to enable these technologies to be eligible for

funding. The NYS NRCS is also considering these technologies to be eligible under the Environmental Quality Incentives Program (EQIP) in the future.

Outreach of this grant opportunity enabled Orleans County agriculture to be recognized across the region, the State, and the Nation. This project reduced pesticides being released in the Great Lakes Watershed and changed conservation incentive based programs throughout New York State. Farms in NYS are more aware of the benefits and restrictions of technologies that are available on today's orchard sprayers. These technologies will help farmers meet the growing environmental restrictions and improve profitability.

Using spray technology to reduce cost and off-target impact - results from the 2007-8 trials in Orleans Co.

Andrew Landers, Cornell University, Geneva, NY 14456

In 2007-8 growing seasons ten progressive apple growers in Orleans County, farming 1400 acres of fruit trees, purchased, with the assistance of a 50% EQUIP Conservation Innovation Grant, ten tower sprayers fitted with ultrasonic detectors. The Durand Wayland SmartSpray™ device uses ultrasonic waves which are reflected by the tree canopy. 9 of the tower sprayers were Durand Wayland or Bean sprayers and one was a Rears tower sprayer fitted with a SmartSpray™ sensors and an adjustable airflow louvre.

Sensors and ultrasonic emitters are mounted on both sides of the sprayer, at the front, to allow time for the processor to operate the valves near the sprayer manifold. When sound waves are reflected back to a sensor, the electrically operated valve controlling the corresponding nozzles opens, allowing the nozzles to emit pesticide spray. Sensors are able to recognize the absence or presence of the tree canopy as well as tree height. The 10 sensor configuration has 5 sensors per side, mounted on the side and within a small tower. Each sensor controls a specific group of nozzles on the sprayer manifold, allowing spray to be emitted according to tree height.

Sprayer manufacturers claim vast savings (reduction) in pesticide use and drift. The ten growers began a two year research project with the authors and James Kingston of Orleans County Soil and Water Conservation District to monitor the actual reduction in pesticide use, drift reduction and machine reliability. Research summaries are shown in the tables below.

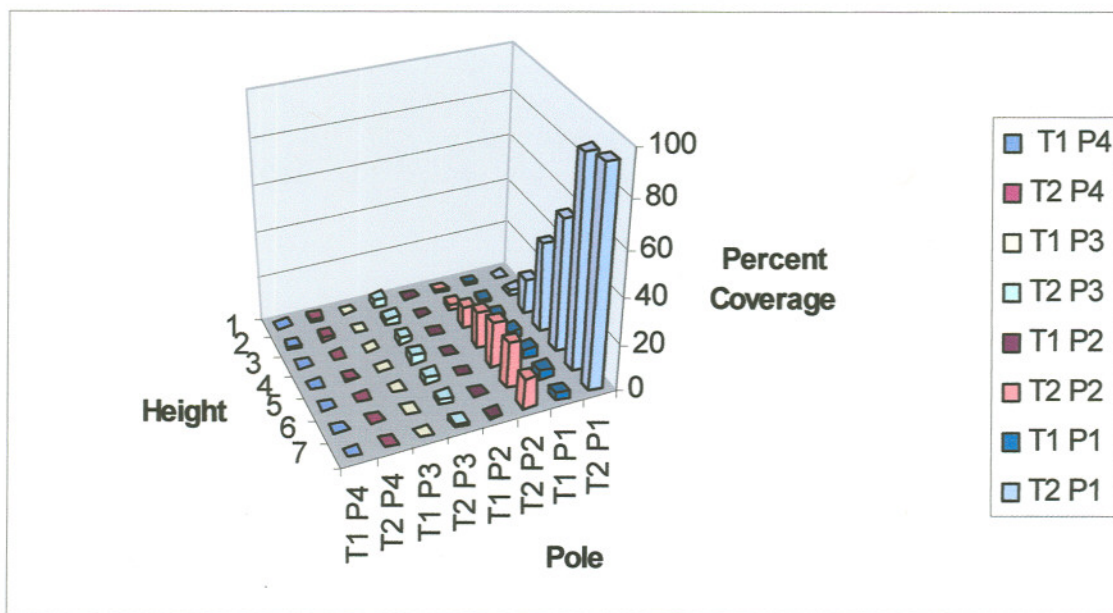
Tree size		Early season	Mid season				Full canopy		
		<i>Brown</i>	<i>Brown</i>	<i>Zingler</i>	<i>Smith</i>	<i>Kast</i>	<i>Kast</i>	<i>Brown</i>	
Large	Manual	45	48	75	49	112	112	48	
	Sensor	41	46	65	42	110	107	43	
	% difference	9	4	14	15	2	4.5	10.4	
Medium	Manual	48	48	94	56	88	88	48	
	Sensor	46	42	76	56	79	85	46	
	% difference	4	13	19	0	10	3.4	4.2	
Small	Manual	48	48	95	42	67	91	48	
	Sensor	45	44	90	39	64	85	46	
	% difference	6	8	5	7	4.5	6.6	4.2	

Table 1 Results from some of the trial sites in the 2007 season

Tree size	Season sprays	Savings/acre with sensors (\$)	Total savings (\$)
Large	Early	0.48	7.50
	Mid	4.89	203.82
	Full	9.71	303.53
Medium	Early	0.25	34.16
	Mid	18.10	6184.05
	Full	4.7	1016.94
Small	Early	0.36	19.67
	Mid	4.39	399.93
	Full	2.79	406.67

TOTAL SAVINGS \$8576.27

Table 2 Savings at Grower A orchard, 2007 season



Key:-

Height Pole location

1-5' 1.5
 2-6'6" 2.0
 3-8' 2.5
 4-9'6" 3.0
 5-11' 3.5
 6-12'6" 4.0
 7-14' 4.5

T1- Louvre closed T2- Louvre open
 P1- P4 drift poles

Figure 1 Drift reduction with Rears sprayer with sensors and adjustable airflow, Semi dwarf trees, 12feet tall, rows 16feet apart, poles placed each row away from the target row

Conservation Innovation Grant: Technology Component

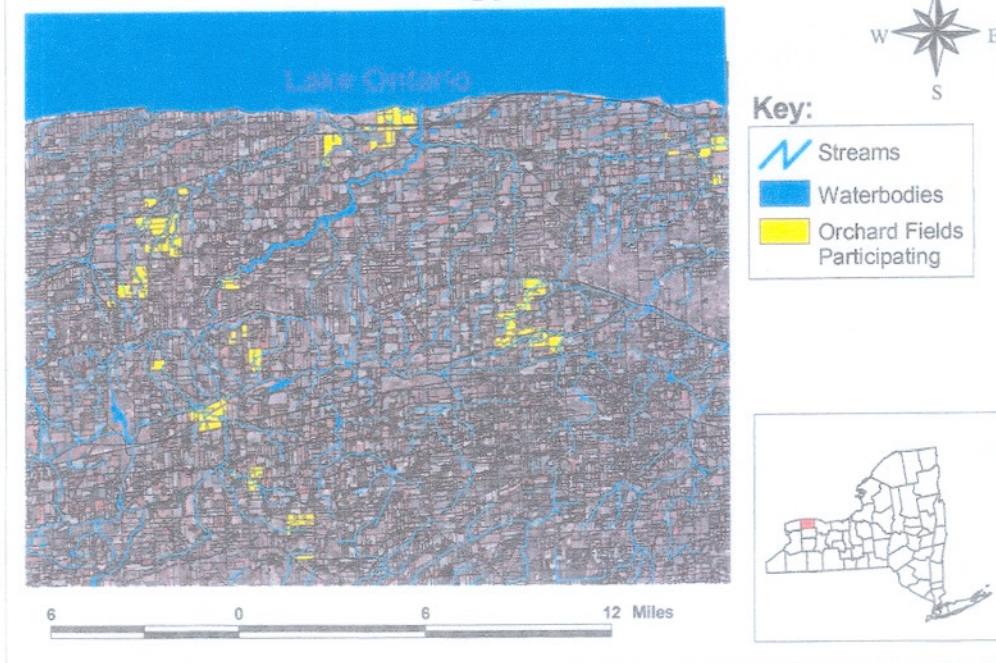


Figure 2 Location of the orchards

Extension activities

Field meetings

5 extension meetings were held each growing season, 2007 and 2008, at the grower's orchards to see the sprayer in action.. Approximately 12 growers attended each meeting – small numbers but the purpose of the event was for the small number to engage with the host grower and operator. Most of the growers were local to the Lake Ontario fruit area. At least one other field meeting was given by James Kingston to NY officials of DEC/Ag and Markets/NRCS.

A much larger audience, 260 approx. attended the Cornell University Fruit field day at Geneva, NY, July 2007 to see the sprayer in action.

Conferences

James Kingston and Andrew Landers gave a joint presentation on this project at the NY Fruit Expo, Syracuse, February 2008. I gave 10 presentations per year to numerous groups across the USA, from Washington Tree fruit growers to Pennsylvania apple growers and showed them powerpoint slides and results. I also gave a presentation to the Great Lakes Fruit group, research and extension educators surrounding the great lakes. I also wrote magazine articles in the Good Fruit Grower, April 2009.

Comment

This project has been an excellent example of cooperation between Cornell University, Orleans Co Soil and Water District and co-operating apple growers. Growers were only too pleased to assist our field trials for quantity and drift measurement.

The savings made by sensors has shown growers how to save money and reduce environmental pollution. The amount of savings varies with grower, but in a nutshell:
Savings vary according to tree size, shape, trellis system, growth stage, number and cost of sprays. Where the grower has a modern fruit wall type system, savings are very low, where there are gaps in the trees, wide canopies etc savings can be quite large, for example a modern trellis of spindle trees gave zero reduction in spray used, but individual cherry trees gave 25% reduction.

Mechanically the sprayers stood up to the task. Initial teething troubles were soon passed and now growers have nearly paid for them in savings. The question of service is still a major issue and we are encouraging the sprayer manufacturer to develop a remote diagnosis system to reduce dealer time in travelling to the orchards. The current dealer is some 1.5 -2 hours away from the farms. One advantage of this technology is that it can be switched off and used in a manual mode.

The local sprayer dealer has since sold more of this type of sprayer. As I speak all over the country, more and more growers are interested in the success and results from this project.

We had very good cooperation, much interest and this subject has now developed further. I spoke to the specialty Crops Research Initiative from Washington, D.C and now have a grant to develop the theme of sensor sprayer technology further.

Acknowledgements

I wish to acknowledge the support of the cooperating growers in allowing us to conduct trials and hold extension meetings at their farms. I wish to thank James Kingston for his wonderful enthusiasm for this project and his input – he has been a tremendous boon to the apple industry in making this all happen.


Andrew Landers

4th December 2009

FINANCIAL STATUS REPORT

(Short Form)

(Follow instructions on the back)

1. Federal Agency and Organizational Element to Which Report is Submitted USDA NRCS (Conservation Innovation Grant)		2. Federal Grant or Other Identifying Number Assigned By Federal Agency NRCS 68-3A75-6-162		OMB Approval No. 0348-0038	Page of 1 1 pages
3. Recipient Organization (Name and complete address, including ZIP code) Orleans County Soil & Water Conservation District 446 West Avenue, Albion, NY 14411					
4. Employer Identification Number 16-6013581		5. Recipient Account Number or Identifying Number		6. Final Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
7. Basis <input checked="" type="checkbox"/> Cash <input type="checkbox"/> Accrual					
8. Funding/Grant Period (See instructions) From: (Month, Day, Year) 2/1/06		To: (Month, Day, Year) 12/31/09		9. Period Covered by this Report From: (Month, Day, Year) 12/31/08	
		To: (Month, Day, Year) 12/31/09			
10. Transactions:		I Previously Reported	II This Period	III Cumulative	
a. Total outlays		465,561.10	7,500.00	473,061.10	
b. Recipient share of outlays		233,061.10	4,000.00	237,061.10	
c. Federal share of outlays		232,500.00	3,500.00	236,000.00	
d. Total unliquidated obligations					
e. Recipient share of unliquidated obligations					
f. Federal share of unliquidated obligations					
g. Total Federal share(Sum of lines c and f)				236,000.00	
h. Total Federal funds authorized for this funding period					
i. Unobligated balance of Federal funds (Line h minus line g)				236,000.00	
11. Indirect Expense	a. Type of Rate(Place "X" in appropriate box) <input type="checkbox"/> Provisional <input type="checkbox"/> Predetermined <input checked="" type="checkbox"/> Final <input type="checkbox"/> Fixed				
	b. Rate	c. Base	d. Total Amount 0.00	e. Federal Share	
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.					
13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.					
Typed or Printed Name and Title Judy Bennett, Secretary/Treasurer			Telephone (Area code, number and extension) (585)589-5959		
Signature of Authorized Certifying Official 			Date Report Submitted 12/23/09		

REQUEST FOR ADVANCE OR REIMBURSEMENT <i>(See instructions on back)</i>		OMB APPROVAL NO. 0348-0004		PAGE 1	OF 1	PAGES
		1. TYPE OF PAYMENT REQUESTED a. "X" one or both boxes <input type="checkbox"/> ADVANCE <input checked="" type="checkbox"/> REIMBURSEMENT b. "X" the applicable box <input checked="" type="checkbox"/> FINAL <input type="checkbox"/> PARTIAL		2. BASIS OF REQUEST <input checked="" type="checkbox"/> CASH <input type="checkbox"/> ACCRUAL		
3. FEDERAL SPONSORING AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH THIS REPORT IS SUBMITTED USDA NRCS (Conservation Innovation Grant)		4. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER ASSIGNED BY FEDERAL AGENCY NRCS 68-3A75-6-162		5. PARTIAL PAYMENT REQUEST NUMBER FOR THIS REQUEST 1		
6. EMPLOYER IDENTIFICATION NUMBER 16-6013581	7. RECIPIENT'S ACCOUNT NUMBER OR IDENTIFYING NUMBER	8. PERIOD COVERED BY THIS REQUEST FROM (month, day, year) 12/31/08 TO (month, day, year) 12/31/09				
9. RECIPIENT ORGANIZATION Name: Orleans County Soil & Water Conservation District Number and Street: 446 West Avenue City, State and ZIP Code: Albion, NY 14411		10. PAYEE (Where check is to be sent if different than item 9) Name: Number and Street: City, State and ZIP Code:				
11. COMPUTATION OF AMOUNT OF REIMBURSEMENTS/ADVANCES REQUESTED						
PROGRAMS/FUNCTIONS/ACTIVITIES ▶	(a)	(b)	(c)			
	Precision Sprayers	Personnel (SWCD)	Contractual	TOTAL		
a. Total program outlays to date <i>(As of date)</i>	\$ 441,061.10	\$ 20,000.00	\$ 12,000.00	\$ 473,061.10		
b. Less: Cumulative program income	212,000.00	12,000.00	8,500.00	232,500.00		
c. Net program outlays (Line a minus line b)	229,061.10	8,000.00	3,500.00	240,561.10		
d. Estimated net cash outlays for advance period				0.00		
e. Total (Sum of lines c & d)	229,061.10	8,000.00	3,500.00	240,561.10		
f. Non-Federal share of amount on line e		8,000.00	0.00	8,000.00		
g. Federal share of amount on line e		0.00	3,500.00	3,500.00		
h. Federal payments previously requested				0.00		
i. Federal share now requested (Line g minus line h)	0.00	0.00	3,500.00	3,500.00		
j. Advances required by month, when requested by Federal grantor agency for use in making prescheduled advances	1st month			0.00		
	2nd month			0.00		
	3rd month			0.00		
12. ALTERNATE COMPUTATION FOR ADVANCES ONLY						
a. Estimated Federal cash outlays that will be made during period covered by the advance				\$		
b. Less: Estimated balance of Federal cash on hand as of beginning of advance period						
c. Amount requested (Line a minus line b)				\$ 0.00		

CERTIFICATION

I certify that to the best of my knowledge and belief the data on the reverse are correct and that all outlays were made in accordance with the grant conditions or other agreement and that payment is due and has not been previously requested.	SIGNATURE OR AUTHORIZED CERTIFYING OFFICIAL 	DATE REQUEST SUBMITTED December 23, 2009
	TYPED OR PRINTED NAME AND TITLE Judy Bennett, Secretary/Treasurer	TELEPHONE (AREA CODE, NUMBER, EXTENSION) (585)589-5959

This space for agency use

Public reporting burden for this collection of information is estimated to average 60 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0004), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

INSTRUCTIONS

Please type or print legibly. Items 1, 3, 5, 9, 10, 11e, 11f, 11g, 11i, 12 and 13 are self-explanatory; specific instructions for other items are as follows:

<u>Item</u>	<u>Entry</u>	<u>Item</u>	<u>Entry</u>
2	Indicate whether request is prepared on cash or accrued expenditure basis. All requests for advances shall be prepared on a cash basis.		activity. If additional columns are needed, use as many additional forms as needed and indicate page number in space provided in upper right; however, the summary totals of all programs, functions, or activities should be shown in the "total" column on the first page.
4	Enter the Federal grant number, or other identifying number assigned by the Federal sponsoring agency. If the advance or reimbursement is for more than one grant or other agreement, insert N/A; then, show the aggregate amounts. On a separate sheet, list each grant or agreement number and the Federal share of outlays made against the grant or agreement.	11a	Enter in "as of date," the month, day, and year of the ending of the accounting period to which this amount applies. Enter program outlays to date (net of refunds, rebates, and discounts), in the appropriate columns. For requests prepared on a cash basis, outlays are the sum of actual cash disbursements for goods and services, the amount of indirect expenses charged, the value of in-kind contributions applied, and the amount of cash advances and payments made to subcontractors and subrecipients. For requests prepared on an accrued expenditure basis, outlays are the sum of the actual cash disbursements, the amount of indirect expenses incurred, and the net increase (or decrease) in the amounts owed by the recipient for goods and other property received and for services performed by employees, contracts, subgrantees and other payees.
6	Enter the employer identification number assigned by the U.S. Internal Revenue Service, or the FICE (institution) code if requested by the Federal agency.	11b	Enter the cumulative cash income received to date, if requests are prepared on a cash basis. For requests prepared on an accrued expenditure basis, enter the cumulative income earned to date. Under either basis, enter only the amount applicable to program income that was required to be used for the project or program by the terms of the grant or other agreement.
7	This space is reserved for an account number or other identifying number that may be assigned by the recipient.	11d	Only when making requests for advance payments, enter the total estimated amount of cash outlays that will be made during the period covered by the advance.
8	Enter the month, day, and year for the beginning and ending of the period covered in this request. If the request is for an advance or for both an advance and reimbursement, show the period that the advance will cover. If the request is for reimbursement, show the period for which the reimbursement is requested.	13	Complete the certification before submitting this request.
Note:	The Federal sponsoring agencies have the option of requiring recipients to complete items 11 or 12, but not both. Item 12 should be used when only a minimum amount of information is needed to make an advance and outlay information contained in item 11 can be obtained in a timely manner from other reports.		
11	The purpose of the vertical columns (a), (b), and (c) is to provide space for separate cost breakdowns when a project has been planned and budgeted by program, function, or		