Engaging Farmers and Agribusinesses to Advance 4R Nutrient Stewardship Practices in Harford County, Maryland (The Precision Ag "Voucher" Program)

With funding from the Chesapeake Bay Trust during 2021-2022, The Nature Conservancy (TNC) engaged two agribusinesses to work with a total of 12 farmers to promote precision agricultural practices through a unique "voucher" program. Under this program, each enrolled farmer received a $1,000 voucher to put toward the expenses associated with advisor time, data entry, soil sampling, map generation, and other precision nutrient management technologies. The voucher money removed a financial barrier to advancing farmer familiarity with and use of these tools on their farms and intentionally did not require implementation of any technologies. This approach was impactful with farmers; an agribusiness partner reported that several farmers were willing to participate and explore precision nutrient management options available to them specifically because they were not committing to taking any actions up-front. As a result of taking the time to work with an agribusiness advisor to learn about options and become familiar with them, participants had fields evaluated and mapped for sub-field management zones, enrolled in a nitrogen management tool to better understand and respond to nitrogen dynamics in their fields during the growing season, and committed to variable rate fertilizer application on their newly analyzed field management zones. The majority of farmers who were interviewed reported that the voucher had encouraged them to adopt precision management for the first time or significantly expand their use of precision agricultural practices. Overall, without requiring implementation as part of the program, at least 2,464 acres received enhanced nutrient management practice planning and most of these acres were moving forward with implementation in 2022. The value of this program—especially its ease of enrollment and flexible structure—was widely praised by participating growers. Participants widely agreed that this program was an effective tool to encourage behavior changes that produce economic benefits to growers and environmental outcomes more widely.

Our project's goals were to reach 50 farmers through the field day, enroll 10 farmers in the voucher program, and increase the implementation of advanced nutrient management practices on at least 1,000 acres, leading to water quality improvements. The project measured success by the number of farmers, agribusiness and government agency representatives who were reached directly through our field day focused on promoting the adoption of advanced nutrient management practices; a sign-in sheet at the event recorded a total of 52 individuals in attendance including at least 21 farmers. We also aimed to enroll 10 farmers in the voucher program. Due to high interest, TNC provided funding to enroll an additional 2 farmers for a total of twelve. As a result of farmers working with agribusiness advisors through the voucher program, we were able to account for 2,464 acres that received enhanced nutrient management practice planning, exceeding our goal of 1,000 acres. Additional details on precision nutrient

management planning and implementation resulting from the voucher program include the following:

- Three farmers with a total of 268 acres had old or incompatible equipment for measuring yields. They were assisted with data management and uploading information to computer software to begin the process of creating sub-field size management units with the goal of ultimately moving toward variable rate application of nutrients. Without assistance with these steps, these farmers would have had no way of taking advantage of variable rate nutrient management practices.
- 85 fields were re-zoned based on soil characteristics and/or yield history to create 276 management units on 2,137 acres.
- 517 acres were enrolled in an in-season N management tool.
- 1,358 additional acres are planned to be enrolled in the N management tool.
- Variable rate application of phosphorus and potassium occurred on 151 acres.
- Variable rate application of nitrogen occurred on 145 acres.
- Variable rate application of nutrients (N & S) was planned on 2,028 acres.
- Of those 2,028 planned acres, variable rate maps were generated on 473 acres with an estimated savings of 6,761 pounds of N.

Based on social science interviews with participating growers and agribusinesses post-practice implementation, the voucher program played a critical role in generating these outcomes. Participating growers specifically emphasized that the incentive money paired with expert technical support encouraged and enabled them to significantly expand their deployment of precision agriculture management.

Key Takeaways:

1. That the voucher program did not require any specific practices, only focusing on precision-agriculture efforts generally, enabled it to meet individual farmers where they are currently at in their adoption journey, while also being adaptable to their operation's specific constraints or opportunities.
    - Feedback from agribusinesses indicated that not requiring implementation of any practice as a condition of participating in the voucher program encouraged three "late adopter" farmers to explore enhanced nutrient management options on their farms. This was a great success, as the traditionally "late adopter" individuals are the hardest to engage with new practices and technologies. These farmers also had some of the greatest impediments to adopting precision nutrient management, including data organization, management, and input into software programs. Two of these participants were in the process of enrolling their farms into the in-season nitrogen management tool to explore its applicability to their management of this nutrient.
    - Even among more progressive farmers, post-project evaluation interviews suggest the voucher program proved an effective stimulant of pro-environmental behavior change for the majority of participants. As one farmer described, he had already intended "doing 50% of [his] acreage" using variable rate nitrogen application. However, because of the voucher program he, "made the decision to run it on every acre"

(V03). In this specific case, $1,000 from the voucher program helped encouraged this producer to use variable rate application on *an additional 700 acres.*

2. The program's simple enrollment and payment process was key to its popularity. There was limited paperwork for the participating grower (most fell on the agribusiness), and the voucher money was rapidly accessible. Interviewees favorably contrasted our program with existing government programs, especially noting that rapid access to the funds reduced risks associated with participating in federal programs that can take "a full year, to possibly going on two years" (JT) before the promised incentive funds are available.

Lessons learned:

1. Maintain overall simplicity of enrollment and paperwork but increase requirements for specific data to be included in the request for reimbursement for more accurate accounting of acres in specific practices and quantity of avoided nutrients.
2. Have participants fill out W9 forms at the time of enrollment rather than at the end of the project for ease of managing program paperwork.
3. Lengthen the project duration to be able to obtain information about what practices were implemented. This project ended in the middle of the growing season, so we only had information about planned, rather than implemented, practices resulting from the voucher program.
4. Consider offering agribusiness advisors incentives for each farmer enrolled in the voucher program, or otherwise find ways to engage agribusinesses that are not structured to do precision agriculture outreach with farmers.
5. Money budgeted for practice implementation was not used even after being repeatedly offered to the participating agribusinesses. However, in the post project interviews, agribusinesses expressed a need for this. The timeline of the project may have interfered with having the funding available at the right time since the project was ending as farmers were getting to the implementation phase. This required more evaluation since we did see significant implementation without additional funding.
6. Interviewed growers felt in-person engagement during the field day was critical, but that more effort should be made to increase farmers' awareness of these field days. For instance, an interviewee noted they had only "just happened to be at that field day last year when I heard about it" (VO1). This participant and others felt more growers are likely interested in participating, suggesting that lack of farmer awareness also reduced program enrollment/use of funding. Future field days promoting incentive programs should be accompanied by more intentional advertising/recruiting efforts to ensure widespread participation.
7. An agribusiness partner and our farmer participants reported that the field day was useful for identifying interested farmers, but that field demonstrations of equipment and technologies may not be necessary to attract farmers. Therefore, an educational gathering with a meal may be scheduled at times of the year other than summer if necessary for a given project's timeline.

Next Steps:

1. The Mid-Atlantic 4R Alliance is seeking funding to expand this program to other geographies within Chesapeake Bay watershed.
2. Ensure agribusiness partners have a dedicated precision agriculture program and support staff with technical expertise.
3. Lengthen timeline of project to cover time for outreach, planning, and implementation of new practices.
4. Consider increasing voucher payment levels. Farmers emphasized that $1,000 was important, but for some with larger operations it covered only a small portion of the true cost of the precision practices they adopted. In particular, higher voucher payments could potentially encourage more widespread adoption among "late adopters" or those new to precision agriculture management.
5. Fertilizer prices are currently at historically high rates. This context directly motivated growers' interest in precision management and our voucher program. If input prices should significantly fall in the future, higher payments may be particularly important to encouraging new adoption.
6. We are evaluating the potential to draft this material into a peer-reviewed academic publication.

In conclusion, the simplicity of the voucher program paired with the trusted relationships between farmers and agribusinesses providing precision agricultural services resulted in increased adoption of advanced nutrient management practices among farmers in Harford County, Maryland. We aim to take the strengths of this pilot program along with the lessons learned to expand the voucher program into additional geographies within the Chesapeake Bay using a larger network of trusted agribusiness partners.