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# How to Grow and Sell Carbon Credits in US Agriculture

This report compares the requirements to grow and sell carbon and environmental services credits across eleven private voluntary agricultural programs in the United States.

## Why agriculture credits?

A growing number of private initiatives are offering farmers compensation for the generation of agriculture carbon credits as well as other ecosystem services such as improvements in water quality. Credits and ecosystem services are expected to be purchased by large corporations and other entities pursuing a reduction in their environmental footprints. Some large corporations are already purchasing carbon credits generated outside agriculture to comply with environmental regulations and to improve their appeal to environmentally-conscious stakeholders.

According to a 2019 report by the National Academy of Sciences, agricultural practices to enhance soil carbon storage can sequester 250 million tons of carbon dioxide annually in the US, equivalent to around 4% of the country's emissions. An economic assessment conducted by IHS Markit in 2018 concludes that the potential demand for agriculture carbon credits in the US is 190 million tons per year, falling short from the supply potential of 326 million tons per year. That report estimated the size of the US market for carbon credits at \$5.2 billion, and the market for other ecosystem services related to nitrogen and phosphorous management at \$8.7 billion annually.

In an attempt to jumpstart the incipient voluntary agriculture credits market, a few large companies have announced their intentions to purchase credits in the near future: Microsoft announced an agreement with Truterra, while IBM, JP Morgan Chase, Boston Consulting Group, Dogfish Head Craft Brewing, Shopify, Anheuser-Busch, and Barclays announced agreements with Indigo Ag. However, little is known about the exact details

of those transactions. On the supply side, Peoples Company announced the enrollment of 20,000 managed acres with CIBO Impact in January 2021.

The complexities involved in the comparison of agriculture carbon initiatives might discourage agricultural producers from properly evaluating relevant alternatives, resulting in a protracted adoption process, and even an accelerated dis-adoption process if initiatives fail to satisfy producers' expectations. The **Growing Climate Solutions Act of 2021**, which cleared the Senate on June 24, 2021 by a vote of 92-8, supports the development of a voluntary market for agriculture credits derived from the prevention, reduction, or mitigation of greenhouse gas emissions (GHG) or carbon sequestration on agricultural land. The Act creates a voluntary certification program managed by the United States Department of Agriculture (USDA) to help solve technical entry barriers that might prevent farmer participation in private initiatives. In particular, the Act provides the Secretary of Agriculture with an advisory council tasked with ensuring that the USDA certification program remains relevant, credible, and responsive to the needs of farmers and carbon and ecosystem services market participants alike. The advisory council will be composed of a majority of farmers and forest landowners in addition to other agriculture experts, scientists, producers, and others. In an attempt to help farmers navigate the complexities associated with carbon and ecosystem services programs, the present report compares 11 private voluntary programs across 26 variables. The programs include two carbon and ecosystem services credit entities (Ecosystem Services Market Consortium-ESMC and Soil and Water Outcomes Fund), two carbon credit entities (Indigo and Nori), four input suppliers (Agoro Carbon Alliance, Bayer, Corteva, and Nutrien), and three data platforms (CIBO Impact, Gradable, and TruCarbon).

### How was the data collected?

We developed a set of 26 questions based on conversations with farmers and agricultural stakeholders, using the article by Sellars and colleagues (2021) as a reference. We answered the questionnaire in as much detail as possible based on publicly available information collected via online search and interviews with representatives from some of the 11 carbon programs. A list of sources is available in the last section of this report.

### What are the main findings?

The emerging agriculture credits market can be currently characterized as an unarticulated patch of coexisting programs with different rules, incentives, and penalties, rather than as a cohesive and transparent market where the same activity has the same implication across programs. In its formative stage, the incipient agriculture credits market is very dynamic, focused on testing protocols through small-scale pilot programs, and lacks transparency and liquidity. The side-by-side comparison of the 11 programs is organized into four groups, corresponding to Tables 1-4: carbon and ecosystem services credit entities, carbon credit entities, input suppliers, and data platforms.

While all programs require **additionality** to generate a credit, not all programs require that farmers change their production practices.

**Additionality** means that farmers must do something **different** to reduce carbon and increase ecosystem services. However, programs use a wide array of benchmarks to determine what is **different**. Some programs require a change of practices with respect to past practices on the same field, while some others require that practices in the field be different from common practices in the area (even if the same practices have been implemented for many years in the field under consideration). See “credit generation” in Tables 1-4.

With the exception of Bayer Carbon, which compensates farmers for implemented practices, all other programs compensate farmers for carbon credit generation. Carbon credits are designed to be purchased by carbon emitters to offset their emissions while maintaining overall emission below certain thresholds, or to reduce their

overall carbon footprint. Some programs also offer farmers the possibility of selling carbon insets to downstream companies that use agricultural commodities in their supply chains. For example, food and beverage companies interested in lowering their supply chain overall emissions could purchase carbon insets from agricultural producers.

Carbon insets are not designed to offset emissions in other parts of the supply chain, but rather reduce its overall GHG emission footprint. A major difference between practices that generate carbon offsets and those that generate carbon insets is their permanence: while the former need to be maintained for long periods of time, the latter might be only temporarily implemented. Another major difference is that while an agriculture carbon credit can only offset one ton of carbon emitted somewhere else, a temporary carbon inset can be claimed by multiple actors within the supply chain and across supply chains. For example, carbon insets in soybean production can be claimed within the same value chain by the crushing plant, the food processing plant that uses soybean oil, the retailer that sells the processed food and the oil; as well as across value chains by hog producers, biodiesel plants and gas stations, and cosmetic products using soy derivatives.

### Further Considerations

An advantage of the emerging agriculture credits market over the failed carbon credit exchange from the late 2000s is that the expected farm size to participate in the carbon market is much smaller than before (Ribera and McCarl, 2009).

As protocols to generate agriculture credits become more encompassing and transparent, a price discovery process for agriculture credits becomes functional, and credit buyers build trust in the integrity of the system and the permanence of carbon reductions, the agriculture credits market should consolidate and possibly grow. As long as buyers of agriculture credits perceive differences in the quality of credits generated through alternative protocols, it can also be expected that initiatives generating high-quality credits will gain market share while other initiatives will exit the market (via bankruptcies or mergers and acquisitions).

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The latter represents a systemic risk for farmers and credit buyers. The risk to farmers could be partially mitigated through the standardization of equivalences for farming practices across initiatives, and the introduction of transferable partial and full credits across protocols. However, the risk of a shorter-than-expected permanency of a carbon credit triggered in the event that a program exits the market and farmers who sold credits through that program discontinue the practices before the expiration of the retention period is only partially mitigated in a few programs through retained carbon credits. Credit reversals are a liability for which there is currently no insurance policy available. This could be a limiting factor for growth in the voluntary agriculture credit market.

While carbon credits are the major focus of the present article, other ecosystem markets from agricultural production could develop in the future to foster water quality and quantity, wetlands, pollinators, and biodiversity. The performance of the voluntary agriculture credits market will set a precedent for those other markets.

A companion publication, AgDM File A1-77, [How do Data and Payments Flow through Ag Carbon Programs?](http://www.extension.iastate.edu/agdm/crops/pdf/a1-77.pdf), www.extension.iastate.edu/agdm/crops/pdf/a1-77.pdf, presents flowcharts to show the direction data, payments, methods, and carbon credits move within each carbon program.

## More Information

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[Bayer Carbon](http://bayercarbon.com) bayercarbon.com

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[Soil and Water Outcomes Fund](http://theoutcomesfund.com) theoutcomesfund.com

[TruCarbon](http://truterraag.com/Carbon) truterraag.com/Carbon

All links accessed June 2021.

**Table 1. Carbon and Ecosystem Services Market Entities**

Voluntary Program	ESMC (Market Launch Information)	Soil and Water Outcomes Fund
Ecosystem services covered	Carbon offsets, carbon insets, improvements in water quality and quantity, and biodiversity.	Carbon dioxide equivalents (soil carbon sequestration and nitrous oxide reductions) and water quality (nitrogen and phosphorous improvements)
Geographical coverage	Portions of the Corn and Soybean Belt, Southern and Northern Great Plains, Great Lakes, Pacific Northwest and CA.	Selected areas in 9 States: DE, IL, IA, MD, NY, OH, PA, VA, WV.
Eligible crops	Cropland and rangeland	All crops in selected areas
Covered new practices	Agricultural practices referenced in NRCS Conservation Practice Standards. Non-NRCS recognized practices may be used, provided there are sufficient published scientific data and outcomes justify their use.	List not prescriptive, but includes no-till, cover crops, land retirement, conversion to pasture, extended rotations.
Minimum acreage enrollment	None	None
Minimum contract length	Carbon offsets: 10 years, renewable to a maximum of 20 years. Other ecosystem services: TBD.	1 year, annual renewal
Payment currency	Not specified	Cash
Payments per new practice	Not applicable	Not applicable
Payments per new carbon credit and environmental services	Not specified. Based on ESMC quantification, verification and third-party certification.	Up to \$40 per acre per year across all environmental services.
Payment for past practices/ carbon removal (look-back)	Not for carbon credits. Evaluating payments for past carbon insets.	None
Payment schedule	Annual for carbon credits and water quantity. Every 5 years for carbon insets.	50% after signing agreement (spring), 50% after annual verification (November/December)
Required data sharing	Detailed farm operational data for carbon credits. Some operational data for carbon insets. Soil sampling and remote sensing data for both.	To enroll: 2-3 years of historical data, and 2-3 years of proposed practice change: field data, agricultural data crop rotations, fertilization rate, seeding type and rates, tillage type, residue management, and manure applications). Once enrolled: environmental data (includes soil and water sampling results).
Other requirements	Not specified	Must <a href="#">enroll fields in online account</a> at theoutcomesfund.com, map field boundaries, and enter baseline and future cropping system information. Review the proposed payment offering emailed within 1-2 weeks after data submission and determine if you wish to continue to participate. E-sign the contract to confirm participation. Fields must comply with the USDA Highly Erodible Land and Wetland Conservation provisions.
Credit generation	Own credit and asset generation protocol based on soil sampling, a proprietary model, and remote sensing. Under review by Gold Standard.	Environmental outcomes and payments are estimated using a publicly supported model (COMET Farm and Nutrient Tracking Tool) and soil and water testing.
Credit verification	Third-party verification: site visits to small subset of randomly selected producers and remote sensing.	Verification by Soil and Water Outcomes Fund: Yearly field visits, remote sensing.
Limit to credits and outcomes per acre	Not available	Limits on water quality outcomes per acre are location dependent.
Storage of carbon credits	Not available	None. Soil and Water Outcomes Fund arranges the sale of credits and outcomes with guaranteed buyers prior to contracting with farmers.
Retained carbon credits	Not available	None
Soil tests required	At offset and every 5 years	Yes, on 10% of the fields
Out of pocket program costs	None	None
Other costs	Soil sampling paid by ESMC and included in credit/asset price to buyer.	Soil and water tests paid by Soil and Water Outcomes Fund.
Breach of contract	Soil carbon gains must be realized before additional credit issuance or payment.	Farmer would not receive payment.

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Voluntary Program	ESMC (Market Launch Information)	Soil and Water Outcomes Fund
Agronomic assistance	Provided by ESMC's member organizations and partners, such as conservation districts and NGOs.	Free conservation agronomists on staff.
Stacking payments	Stacking with government payments is allowed, but not with other private programs. ESMC stacks carbon credits with other environmental credits/assets internally.	Not allowed to stack other government or ecosystem service payments from other programs.
Other information	No enrollment fee or requirement to purchase ag products; producers may be responsible for potential program expenses; ESMC is a non-profit subsidiary of the Soil Health Institute.	Soil and Water Outcomes Fund is a partnership of AgOutcomes (a subsidiary of the Iowa Soybean Association) and ReHarvest Partners (a subsidiary of Quantified Ventures). Soil and Water Outcomes Fund does not sell production inputs or services. Soil and Water Outcomes Fund connects farmers with guaranteed buyers of carbon credits and ecosystem services.
Market launch date	2022-23 (pilots only today)	2020

**Table 2. Carbon Market Entities**

Voluntary Program	Indigo	Nori
Ecosystem services covered	Carbon offsets	Carbon offsets
Geographical coverage	21 states: AR, CO, GA, IL, IN, IA, KS, KY, LA, MN, MS, MO, NE, NC, ND, OH, OK, SC, SD, TN, TX.	US croplands
Eligible crops	Field crops, excluding rice and perennials.	Row crop/hay/grass: Alfalfa, barley, broccoli, carrots, cauliflower, clover, corn (grain or silage), cotton, dry field beans, dry field pea, fallow, grass, grass-legume mix, lettuce, millet, oats, peanuts, potato, rye, sorghum, soybean, strawberries, sugar beets, sunflowers, switchgrass, tomato, wheat (spring or winter). Orchard/vineyard: Almond, avocado, cherry, English walnut, grapefruit, grape, lemon/lime, olive, orange, peach/nectarine, pistachio, tangerine/mandarin.
Covered new practices	Cover crops, targeting nitrogen, reducing tillage, diversifying crop rotation, and grazing livestock.	Changing or expanding crop rotations and cropping intensity; cover crops; shifting from annuals to perennials; reducing tillage events/intensity; adopting new residue management techniques; substituting synthetic fertilizers with organic matter additions.
Minimum acreage enrollment	150 acres in 1 field	1,000 acres
Minimum contract length	5 years, twice renewable	10 years, plus an additional 10-year retention period.
Payment currency	Cash	Nori Carbon Removal Tonnes (NRT) tokens or cash.
Payments per new practice	Not applicable	Not applicable
Payments per new carbon credit	Subject to market conditions. \$15 in 2019; guaranteed \$10 minimum for fields enrolled in 2021 and credits sold before the end of 2022 as part of their first carbon crop.	One NRT token, or a floor price per NRT set by the NRT owner (Nori adds a transaction fee to complete the final price of an NRT to the buyer).
Payment for past practices/carbon removal (look-back)	Possibly, up to 2 growing seasons prior to joining the program	Up to 5 years look-back during the pilot phase; switch date after January 1, 2010
Payment schedule	After Indigo sells credits: 50% paid in year 1 (when credit is generated and sold), 20% in year 2, 10% in years 3-5.	End of month when NRT is sold. A share of the revenue from NRTs sales will not be distributed for 10 years to incentivize retention of the practices that generated the NRTs for 10 years. Some tokens will be restricted based on an NRT score.
Required data sharing	3-5 years of historical data and current season details about planting and harvest dates, tillage, and fertilizer applications.	10 years of historical operating data and at least 3 years of pre-switch operating data or records to support claim of new practice adoption; annual updates on management practices.

**Table 2. Carbon Market Entities**

Voluntary Program	Indigo	Nori
Other requirements	A grower must contract at least one eligible crop field, hold exclusive operating rights to their land, have not cleared the land in the past 10 years, and not receive payments for the land through another carbon credit program. Field cannot contain histosols.	A farm tenant can meet enrollment and continuing data reporting requirements without the land owner(s) assignment of authority for up to 3 years. Nori will issue NRTs to the project when that assignment of authority is received and a Primary Contact named.
Credit generation	Net changes in GHG emissions and soil carbon levels are calculated by Indigo. Carbon credits are independently issued by <a href="https://bit.ly/2TVPE9V">Verra</a> , <a href="https://bit.ly/2TVPE9V">https://bit.ly/2TVPE9V</a> , and <a href="https://bit.ly/3gQVpOa">Climate Action Reserve</a> , <a href="https://bit.ly/3gQVpOa">https://bit.ly/3gQVpOa</a> .	NRTs are only based on the difference between the two soil organic carbon stock change (SOCSC) trends between baseline and new practices or a 10-year annual average, whichever is less. Nori relies solely on the <a href="http://comet-farm.com">Greenhouse Gas Implementation Tool (GGIT)</a> to measure SOCSC trends ( <a href="http://comet-farm.com">http://comet-farm.com</a> ). Farmers can opt to ground-truth model results via soil sampling but must bear associated costs.
Credit verification	Third-party verification: random site visits and evidence checks, registry-approved methodology.	Third-party verification of practices: at offset to qualify for program, at least every 3 years (at most once a year) during the 10-year NRT agreement term following registry-approved methodology; final project audit in year 10.
Limit to credits per acre	2 carbon credits per acre per year	Not specified
Storage of carbon credits	None	Up to 30 days in a first in, first out system.
Retained carbon credits	None	Nori will retain an unspecified share of revenue from the NRT sale for 10 years. If practices that generated the NRT were maintained over that period, Nori will disburse the retained revenue to the NRT seller.
Soil tests required	At offset on a subset of fields. Not specified whether further testing is required.	No, but farmers can opt to ground-truth model results with soil test at their own expense.
Out of pocket program costs	None	Verification costs: at offset, at least every 3 years, and in year 10.
Other costs	Not specified	Soil testing costs if farmers choose to ground-truth model results with soil tests.
Breach of contract	Payment paused until soil carbon returns to previous level.	Temporary breach: farmer commits to make best effort to retain carbon stocks, not liable for force majeure carbon losses. Sustained breach: the contract is invalidated, subject to dispute resolution by arbitration.
Agronomic assistance	Free in-house agronomic support.	None
Stacking payments	Stacking across private and government programs is allowed, but the same field cannot be enrolled in other programs that pay for GHG reduction assets (such as carbon credits).	Stacking across private and government programs is allowed, but the same field cannot be enrolled in other programs that pay for carbon removal and retention
Other information	Fields with tile drainage added or expanded during an Indigo Carbon contract (repair or replacement of preexisting tile drainage is permissible) are disqualified from program participation.	The GGIT model enables farmers to evaluate and choose the best changes in practice. Nori uses blockchain technology to register NRTs transactions. Upon contract renewal, farmers must use updated baselines. The minimum renewal term is likely to be shorter than the initial term.
Market launch date	June 2019	September 2019

**Table 3. Input Supply Companies**

<b>Voluntary Program</b>	<b>Agoro Carbon Alliance</b>	<b>Bayer Carbon</b>	<b>Corteva</b>	<b>Nutrien (Pilots only)</b>
Ecosystem services covered	Carbon offsets and insets	Carbon offsets	Carbon offsets	Carbon offsets and insets, improvements in water quality.
Geographical coverage	Continental states of the United States	17 states: IN, IL, IA, KS, WI, ND, SD, NE, MN, MO, MI, OH, AR, MS, LA, MD, and DE.	3 states in 2021: IL, IN, IA. Expanding to additional states in 2022.	Geographical coverage varies by pilot program, currently operating in more than 15 unspecified US states.
Eligible crops	Focus on corn, soybeans and wheat; but open to other cash crops (orchards, almonds, cotton, etc.)	Corn and soy (intermittent rotation with wheat)	Corn and soybeans	Pilot-dependent, including corn (grain and silage), dairy, wheat, barley, and sweet potato. Unclear which crops will be eligible for market launch.
Covered new practices	No-till or reduced tillage; cover crops; nitrogen management; management of pasture, degraded and livestock lands; agroforestry.	no-till, strip-till, and cover crops	Strip-till or no till; cover crops; reducing nitrogen application.	Nitrogen management via slow release/inhibitors, variable rate nitrogen application; no-till or low-till; cover crops.
Minimum acreage enrollment	500 acres	10 acres per field	None	None
Minimum contract length	10 year contract	10 years (minus any years for which the farmer receives payment for historical practices), plus an additional 10-year retention period.	10 years with annual option to opt-out starting at the end of year 2.	1 to 3 years, depending on pilot.
Payment currency	Cash	Cash	Cash	Cash (pilot programs)
Payments per new practice	Not applicable	\$3 per acre per year no-till/strip-till \$6 per acre per year cover crops \$9 per acre per year both	Not applicable	Not applicable
Payments per new carbon credit	Undisclosed payment per carbon credit. Sign-up incentive of \$10 per acre if farmer enrolls more than 2,560 acres.	Not available	\$15 per carbon credit	Expected \$10-20 per ton of carbon removed, pilot-dependent. Water credits: TBD.
Payment for past practices/ carbon removal (look-back)	Not applicable	One-time payment for up to 5 years of past practices after Jan 1, 2012, at same rate for new practices.	None	None
Payment schedule	Sign-up incentive paid 30 days after signing contract. The first Annual Payment will be made within 60 days of the Start Date and each subsequent Annual Payment will be made within 60 days of each anniversary of the Start Date during the Crediting Period.	Annual, upon practice verification.	Payments made after Corteva sells carbon credits. In pilots, payments made after change of practices is verified.	Pilot-dependent, typically after practice implementation is verified.

**Table 3. Input Supply Companies**

Voluntary Program	Agoro Carbon Alliance	Bayer Carbon	Corteva	Nutrien (Pilots only)
Required data sharing	Current crop year and 5 years of historical field data: crop rotations, nitrogen management, tillage, harvest data, cover crop usage.	Necessary data to verify performance of the practices and calculate the number of carbon credits, including soil samples every 5 years.	Current crop year and 3 years of historical field data: crop type, nitrogen applications, tillage, harvest data, and cover crops use.	Field level practice data, soil samples, and field shape files. Nitrogen management: 3 years of data prior and data for 1 full crop rotation after change in practices. Other practices: 5 years of data prior and 5 years of data after change in practice.
Other requirements	For leased farmland, landowners must consent to tenant's participation in Agoro program.	An active FieldView Plus account	Farmers must show that they will farm the land through the duration of the 2-year commitment and that their landowner agrees to and acknowledges farmers' participation in Corteva's Carbon Initiative.	Not specified
Credit generation	Model-based using Gold Standard Registry and field testing with soil analyses.	Farmers not paid for credits generated. Carbon model not reported.	Practice changes registered in the Granual Insights platform. Data shared with ESMC, who quantifies soil carbon storage and certifies carbon credits.	Nutrien is currently evaluating protocols to measure carbon credits and water quality improvements.
Credit verification	Follows Gold Standard Registry, verified by SustainCERT.	Internal: Data collected through the Climate FieldView™ platform is verified through OpTIS <sup>1</sup> and soil samples every 5 years.	Soil sampling by Corteva, with additional third-party verification for ESMC.	Nutrien is currently evaluating registries to verify carbon credits.
Limit to credits per acre	Not applicable	Not applicable	Not specified	Not specified
Storage of carbon credits	Not applicable (credits are owned by Agoro)	Not applicable	None	Not specified
Retained carbon credits	Not applicable (credits are owned by Agoro)	Not applicable	No. Companies will buy credits from Corteva and Corteva will pay 100% of credit value to farmers.	Nutrien will maintain a carbon credit reserve to compensate setbacks but this will not affect farmers participating in pilot programs.
Soil tests required	Soil tests required in sign-up year, and in years 1, 3, 5 and 10.	At offset and every 5 years.	Yes. Timing and frequency TBD. Tests only measure carbon in the soil (not fertility or other soil characteristics).	Yes. Timing and frequency TBD.
Out of pocket program costs	None	\$99 per year FieldView Plus account; \$550 cost to install FieldView Drive and Starter Kit.	Annual subscription fee to Granual	Maybe verification and soil test costs.
Other costs	None. Certification and soil test costs paid by Agoro.	Soil test and verification costs paid by Bayer.	None. Soil tests and certification costs via ESMC paid by Corteva.	Not specified

<sup>1</sup>OpTIS: [Operational Tillage Information System](http://OperationalTillageInformationSystem.com), [www.ctic.org/OpTIS](http://www.ctic.org/OpTIS), a publicly available automated system that uses remote sensing satellite-based data to monitor conservation practices in agricultural systems.

**Table 3. Input Supply Companies**

Voluntary Program	Agoro Carbon Alliance	Bayer Carbon	Corteva	Nutrien (Pilots only)
Breach of contract	Temporary breach due to weather factors results in delay in annual payment. Permanent breach triggers repayment obligation of cumulative carbon payments by farmers.	Temporary breach evaluated on a case-by-case basis. No penalty for leaving the program. Must notify Bayer in writing at least 30 days prior to the end of the program year.	Temporary breach: reduced carbon crediting resulting in lower payments.	No penalty for pilot programs.
Agronomic assistance	Free agronomic recommendations by local Agoro Carbon agronomists.	Dedicated agronomic support provided.	Free agronomic recommendations by local Pioneer Seed Agents or other Corteva Advisors.	Free in-house agronomic support.
Stacking payments	Agoro currently does not allow stacking payment but that could change in the future.	Stacking across private and government programs is allowed, but the same field cannot be enrolled in other programs that pay for GHG reduction assets (such as carbon credits).	Stacking with public cost-share programs allowed.	Pilot-dependent
Other information	Agoro is an initiative of Yara Crop Nutrition, but participating farmers are not required to purchase inputs from Yara International. Agoro is evaluating ways to develop markets for climate-smart certified crops that capture price premiums. Data will be collected through the Agoro platform.	Program contracts directly with growers; discounts on cover crop seeds are available; no need to purchase Bayer products.	The farm management software Granular is priced as an annual subscription based on crop mix and farm size. After 2 years, farmers can choose to continue with Corteva or a preferred buyer from +60 companies in the ESMC marketplace.	Data will be collected through the Agrible platform.
Market launch date	2021	2020	2021	2022 (pilots only today)

**Table 4. Data Platforms**

Voluntary Program	CIBO Impact	Gradable Carbon	TruCarbon (Pilots only)
Ecosystem services covered	Carbon offsets	Carbon offsets and insets	Current focus on carbon offsets. Plan to add carbon insets and water quantity and quality credits in the future.
Geographical coverage	All US cropland. Pilot of 30,000 acres across 4 farmers in IL	For cover crops: IL, IN, IA, KS, MN, NE, OH, SD, WI; For tillage practices: IL, IA, KS, MN, ND, NE, OH, SD, WI.	19 states: AR, IA, IL, IN, KS, KY, LA, MD, MI, MN, MS, MO, NE, OH, PA, SD, TN, TX, WI.
Eligible crops	All crops	Grain production	Crop rotations must include at least 1 supported crop: corn, soybeans, cotton and winter wheat.
Covered new practices	No-till and low-till; cover crops; nitrogen application; change in crop rotations.	Minimal or no-till; cover crops; reducing nitrogen use; diversifying crop rotation.	Changing or expanding crop rotations and cropping intensity; cover crops; reducing tillage events/intensity; enhanced nitrogen management; shifting from annuals to perennials.
Minimum acreage enrollment	None	Various tiers, but generally 250 acres minimum.	2.5 acres
Minimum contract length	1 year (5- and 10-year contracts available)	5 years	20-years reporting commitment after credit is accrued.

**Table 4. Data Platforms**

Voluntary Program	CIBO Impact	Gradable Carbon	TruCarbon (Pilots only)
Payment currency	Cash	Carbon credits: Farmer chooses when to sell credits. Carbon insets allow farmers to sell their crops through the Low-Carbon™ grain platform.	Cash
Payments per new practice	Not applicable	Not applicable	Not applicable
Payments per new carbon credit	\$20 per carbon credit for pilot program. Farmers set the price of their carbon credits.	Based on market conditions. In 2019-2020, fixed price floor at \$20 per carbon credit. Farmers control timing of credit sale.	Current contracts (pilots) do not specify farmer payments for carbon credits, but for estimated additional carbon removed over the previous 5 years. Future carbon credit prices will be subject to market conditions.
Payment for past practices/ carbon removal (look-back)	No payments for past carbon removal, but carbon credits can be generated based on ongoing practices.	Credits can only be generated for practices adopted on a field 2 years before joining the program.	Up to 5 years look-back during the pilot phase; will vary by program.
Payment schedule	80% of credit value when farmers directly sell their credits to buyers on the CIBO marketplace	60% of credits earned will be issued to farmer over a 5-year period; 25% of credits earned will be withheld to cover avoidable and unavoidable losses of carbon over a 100-year period	Spring 2021 pilots offered full payout in summer 2021 for additional carbon removed in 2016-2020. Terms will change in the future.
Required data sharing	Crop rotation, cover cropping, tillage type, field boundaries, and nitrogen applied for the growing season for which farmers is enrolling; soil tests only if farm is audited.	Data on practices (including planting, fertilizer applications, tillage, and harvest), yields, equipment, etc., each year of participation in the program, as well as up to 5 years of historical practices to establish a baseline in year 1. Gradable distills the adopted practices into a single farm-level score, which allows farms to be rewarded for practices without having to share detailed practice information with buyers.	Field management data including planting, fertility, in-season applications, harvest, cover crop and tillage information.
Other requirements	Farmers must enroll their farms in CIBO Impact online platform.	Must become a member of the Farmers Business Network® (FBN®).	Must enroll fields in Truterra™ Insights Engine. Fields that adopt regenerative practices for more than 5 years are not eligible for TruCarbon. Farmers who operate rented land will be required to provide an attestation of their right to market carbon on the property as part of the required program agreements.
Credit generation	CIBO Impact is its own voluntary carbon marketplace and carbon registry. Carbon credits are based on a model developed at Michigan State University.	Own credit generation protocol based on soil sampling, a proprietary model, <a href="https://bit.ly/3cVpn2n">https://bit.ly/3cVpn2n</a> , and remote sensing.	A combination of soil sampling and an unspecified carbon modeling. Truterra is working with the Soil Health Institute to develop credit generation protocols. Truterra is also collaborating with Nori and Bayer.
Credit verification	Satellite data to verify crop rotation, cover cropping, and tillage practices; time-stamped 'as applied' electronic nitrogen application data must be uploaded by farmers to verify nitrogen management; audit soil sampling of subset of farms every 5 years.	Internal: Data collected through the FBN® platform is verified through remote sensing. On-farm verification for a small percentage of farmers each year.	Third-party verification: organized and paid by Truterra.

**Table 4. Data Platforms**

Voluntary Program	CIBO Impact	Gradable Carbon	TruCarbon (Pilots only)
Limit to credits per acre	None	Varies: 0.25-1.5 credits per acre per year	Not specified
Storage of carbon credits	Farmers retain ownership of the carbon credits. Verified carbon credits from prior seasons are immediately available for purchase on the open CIBO carbon marketplace.	Yes. No limit to storage period.	Not specified
Retained carbon credits	CIBO retains 20% of carbon credits as compensation for transaction fees.	15% credits earned will be retained by Gradable to cover sampling, verification, administration, and fees.	Not specified
Soil tests required	Only required for audited farms every 5 years.	At offset. Not specified whether further testing is required.	Yes. Timing and frequency TBD
Out of pocket program costs	None	None	Not specified
Other costs	Transaction fees paid with retained carbon credits.	Sampling, verification, administration, and other fees paid via retained carbon credits.	Not specified
Breach of contract	None. Farmers stop generating credits in the interrupted farm for the year.	Temporary breach evaluated on a case-by-case basis. Credit generation and program participation can be affected. No penalty for leaving the program.	Temporary breach: risk management strategy employed to account for the limited number of such instances. Details disclosed in program agreements.
Agronomic assistance	None	Agronomic support available for a fee: Gradable Plan™	One-on-one technical support
Stacking payments	Stacking across private and government programs is allowed, but the same field cannot be enrolled in other programs that pay for carbon removal and retention.	Not available	Stacking with public cost-share programs allowed. Might change in the future.
Other information	Upon enrollment, farmers receive a complimentary CIBO Plus Land Platform membership (a \$120 value). CIBO claims that CIBO Impact has been independently verified by farmers through the CIBO Farmers Advisory Network (CFAN), and collaborations with Field to Market.	"Gradable Carbon is an initiative by the Farmers Business Network® (FBN®)."	Not all acres enrolled in TruCarbon will receive a payment. Only those acres that are a priority for a specific buyer offer will receive a payment. TruCarbon is a program by Truterra, which is a wholly owned subsidiary of Land O'Lakes, Inc.
Market Launch Date	Pilots 2020. Full availability expected in 2021.	February 2021	Not specified. Only pilots today.

For flowcharts showing the direction data, payments, methods, and carbon credits move within each carbon program, see AgDM File A1-77, [How do Data and Payments Flow through Ag Carbon Programs?](http://www.extension.iastate.edu/agdm/crops/pdf/a1-77.pdf), [www.extension.iastate.edu/agdm/crops/pdf/a1-77.pdf](http://www.extension.iastate.edu/agdm/crops/pdf/a1-77.pdf).

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