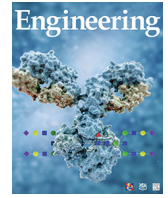




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## News &amp; Highlights

## Farmers Reap Right to Repair Agricultural Equipment

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A farmer is ready to harvest the winter wheat crop when his combine harvester breaks down. Even if the problem would be relatively simple to remedy, the farmer probably cannot make the repair himself or get help from an independent shop because manufacturers have restricted access to the tools, documentation, and other requirements for fixing their equipment [1]. Instead, the farmer will likely have to turn to one of the manufacturer's dealers, which could mean waiting days or even weeks for a service call from a company technician [2]. In the meantime, the farmer's crop sits unharvested, vulnerable to damage or destruction by bad weather [2].

But farmers in Colorado, USA, will soon have another option. This year, the state's governor signed a law that gives farmers control over who repairs their equipment [3]. The law mandates that manufacturers make available "parts, embedded software, firmware, tools, or documentation, such as diagnostic, maintenance, or repair manuals, diagrams, or similar information" so that farmers and independent repair shops can do the work themselves [4]. The US states of Massachusetts [5] and New York [6] have passed "right-to-repair" laws that cover cars and electronics, but Colorado is the first to enact such a law for agricultural equipment [3]. "This is a huge breakthrough," said Paul Roberts, founder of Secure Repairs, an organization based in Boston, MA, USA, that backs the right to repair. Chad Franke, president of the Rocky Mountain Farmers Union in Denver, CO, USA, also lauds the new law. Car owners can decide who fixes their vehicles, but farmers cannot make that choice for their tractors and harvesters, he said. "We have been fighting for this for years. We consider it a fairness issue."

Farmers elsewhere in the country may also gain the right to repair their equipment. Other states are weighing bills like Colorado's [1]. In addition, the biggest US farm equipment manufacturers—Case IH and New Holland (both of which are subsidiaries of London, UK-based CNH Industrial) and Deere & Co. (Moline, IL, USA)—have promised to permit some owner repairs nationwide [2,7]. Deere & Co., the largest company, also faces a class-action lawsuit that could compel it to share its repair software and documentation [8].

Consumers and manufacturers have clashed over who can repair products for decades, and their disputes have frequently ended up in court [9,10]. The issue has become more contentious

as products, including farm equipment, have become increasingly dependent on microchips and internet connectivity. Today's tractors and combine harvesters are rolling computers (Fig. 1), controlled by software and guided by the global positioning system (GPS) [11,12]. Some of the newest models drive themselves [13]. And a barnful of other smart equipment has appeared on the farm, including sprayers and drones [14,15].

Right to repair is not just a farm issue, but it is a big concern for farmers because they contend with unique logistical challenges, said Leland Glenna, professor of rural sociology and science, technology, and society at Pennsylvania State University in University Park, PA, USA. A city resident with a broken iPhone can take it to the nearest Apple store, Glenna said. But in rural areas, the closest agricultural equipment dealership may be more than 100 km away. Moreover, some crops must be harvested within a short period of time. Farmers "can lose a lot of money, or even their livelihood," if their equipment is down during this crucial window, Glenna said. Until recently, farmers were often able to repair their equipment themselves.

However, many types of products, including farm machinery, have become harder to repair, often by design. A notorious example is the unorthodox pentalobe screw that Apple began installing on some of its devices in 2009, which requires a specialized screwdriver to remove [16]. Manufacturers have adopted other strategies to curtail who can service their products and what



Fig. 1. Farmers using the latest computerized, GPS-guided farm equipment, like this (a) tractor and (b) combine harvester, often cannot access the necessary tools, software, spare parts, and information to make needed repairs themselves. New laws and agreements may make it easier for farmers to perform those repairs or hire independent mechanics. Credit: both, Acroterion/Wikimedia (CC BY-SA 4.0).

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replacement parts they can choose [17]. Deere & Co. places digital locks on its tractor software that open only with codes and software that the company furnishes exclusively to its dealers and authorized repair providers [18]. Some desperate farmers have resorted to buying “jailbroken” versions of this software on the black market to disable these locks so they can perform repairs [19]. Another company strategy is parts pairing, in which replacement parts not produced by the original manufacturer and installed by an authorized repairer will not work [20].

Such restrictions are necessary, manufacturers contend, to protect their intellectual property and to ensure that products are safe, functional, and secure from cyberattack [17]. Right-to-repair supporters disagree. The security argument is nonsense, Roberts said. Manufacturers already share tools, diagnostic software, security codes, and product information with thousands or tens of thousands of third parties such as authorized repair facilities, he said. “If sharing such information posed such a dire cybersecurity risk, manufacturers would not be distributing it widely,” Roberts said.

Facing frustrated consumers, lawsuits, and legislation, some manufacturers have softened their resistance to right to repair. Under a program launched in 2022, for instance, Apple ships users in some countries the instructions, parts, and tools needed to mend their iPhones [21]. In 2023, the American Farm Bureau Federation (AFBF), an agricultural trade association located in Washington, DC, USA, announced “memoranda of understanding” with Deere & Co., Case IH, and New Holland in which the companies vowed to make independent repair easier [2,7,22].

Emily Buckman, director of government affairs for the AFBF, said that the agreements cover diagnostic and repair codes, manuals, product guides, and direct purchasing of dealer-specific diagnostic tools that farmers or independent shops need to repair the manufacturers’ equipment. The agreements also include a framework for periodic review. “Technology is evolving,” she said, and the agreements “provide an opportunity for updating to address new and emerging issues.” Critics, however, knock the agreements because they are non-binding, provide no enforcement mechanism, and permit participants to withdraw with 30 days’ notice. The last provision could deter mechanics who are thinking of setting up new repair shops or expanding existing ones to service the manufacturers’ machinery, said Franke. They may be reluctant because they could lose their investment in tools and training if the manufacturer withdraws. That provision is one reason the agreements “are essentially meaningless,” said Aaron Perzanowski, professor of law at the University of Michigan, Ann Arbor, MI, USA.

Regardless, legislation mandating the right to repair for farm equipment is moving ahead. More than ten US states besides Colorado considered bills in 2023 [1], and Franke said that his organization is working to get national legislation passed. An agricultural right-to-repair bill was introduced in the US Congress in 2021, but it never received a vote [23].

Right to repair is also gaining in other countries. Support for it is strong in the European Union, said Enrique Dans, a professor of innovation at IE Business School in Madrid, Spain. For a decade, EU regulations have required farm equipment manufacturers to share information on repair and maintenance with independent dealers. However, Dans noted, the law permits manufacturers to close off parts of their operating software to third parties, a measure designed to prevent tampering with the equipment to, for instance, disable pollution control technology. The European Union has recently introduced or proposed other right-to-repair rules. In 2021, it instituted new regulations that require manufacturers to stock spare parts for some products for 7–10 years after they go off the market [24]. And draft regulations proposed in 2023 would mandate that companies offer repair for products such as appliances and televisions for 5–10 years [25]. But neither of those sets of regulations would cover farm equipment, Dans said.

Australian farmers might also soon have right to repair. Because of the country’s vast distances and relatively sparse population, they may have to travel for more than a day to reach the nearest repair shop, said Leanne Wiseman, professor of law at Griffith University in Brisbane, Australia. Under a mandatory data sharing law that went into effect in 2022, car makers must furnish service, diagnostic, and repair information and software to independent shops [26]. The government is considering whether to bring agricultural machinery under the law. A memorandum of understanding like the ones in the United States is also a possibility, Wiseman said, but a legislative solution like the mandatory data sharing law “would have teeth” because the country’s competition commission would enforce it.

As more governments weigh right-to-repair legislation, some experts caution that these laws must be carefully tailored to avoid unintended consequences. The laws can be a plus for consumers and manufacturers, said Luyi Yang, assistant professor of operations and information technology management at the University of California, Berkeley, CA, USA. They can also reduce waste by encouraging owners to fix products instead of throwing them out—although this is less of an issue for farm equipment, which tends to have a long lifespan. Still, the laws are not always universally beneficial. When Yang and his colleagues analyzed how the introduction of right-to-repair regulations might affect prices, they found that consumers, manufacturers, and the environment can lose in some situations [27].

In the case of moderately expensive items like tractors, the researchers determined that manufacturers would probably initially lower prices to keep their customers. But if regulations meant that repair by independent shops became much cheaper, manufacturers would end up offering free repair and raising prices for new products to maintain profits. Thus, manufacturers and consumers would lose. But so might the environment, Yang said, because users, deterred by the high cost of replacements, could stick with older, possibly more polluting equipment for as long as possible. The paper came out before the Colorado law was signed into law, and the researchers did not analyze its wording. But their study suggests that “identifying the sweet spot” for right-to-repair regulations may be difficult, Yang said.

Whether more US states or the US federal government will pass agricultural right-to-repair laws remains to be seen. But how Colorado’s new law plays out could improve the prospects for additional legislation. If it is a success, Perzanowski said, it will be “a bit easier to try this experiment” elsewhere.

## References

- [1] Bedayn J. 11 states consider ‘right to repair’ for farming equipment [Internet]. New York City: Associated Press; 2023 Feb 14 [cited 2023 May 7]. Available from: <https://apnews.com/article/farm-equipment-repairs-d5ea466725328d965a85a62130503d49>.
- [2] Hernandez J. John Deere vows to open up its tractor tech, but right-to-repair backers have doubts [Internet]. Washington, DC: NPR; 2023 Jan 10 [cited 2023 May 7]. Available from: <https://www.npr.org/2023/01/10/1147934682/john-deere-right-to-repair-farmers-tractors>.
- [3] Bedayn J. Colorado becomes 1st to pass ‘right to repair’ for farmers [Internet]. New York City: Associated Press; 2023 Apr 25 [cited 2023 May 7]. Available from: <https://apnews.com/article/colorado-right-to-repair-farming-equipment-1da00ea957fd1057bf522cb4725e62d4>.
- [4] HB 23–1011 consumer right to repair agricultural equipment [Internet]. Denver: Colorado General Assembly; 2023 [cited 2023 May 7]. Available from: <https://leg.colorado.gov/bills/hb23-1011>.
- [5] Massachusetts to enforce right to repair law starting June 1 [Internet]. Boston: WBZ News; 2023 Mar 8 [cited 2023 May 7]. Available from: <https://www.cbsnews.com/boston/news/massachusetts-attorney-general-andrea-campbell-right-to-repair-law/>.
- [6] Faulkner C. New York breaks the right to repair bill as it's signed into law [Internet]. New York City: The Verge; 2022 Dec 29 [cited 2023 May 7]. Available from: <https://www.theverge.com/2022/12/29/23530733/right-to-repair-law-new-york-tech-hochul-oems-parts>.

- [7] AFBF signs right to repair MOU with Case IH and New Holland [Internet]. Washington, DC: American Farm Bureau Federation; 2023 Mar 9 [cited 2023 May 7]. Available from: <https://www.fb.org/news-release/afbf-signs-right-to-repair-mou-with-case-ih-and-new-holland>.
- [8] Brodtkin J. Colorado Governor signs tractor right-to-repair law opposed by John Deere [Internet]. New York City: Ars Technica; 2023 Apr 26 [cited 2023 May 7]. Available from: <https://arstechnica.com/tech-policy/2023/04/colorado-governor-signs-tractor-right-to-repair-law-opposed-by-john-deere/>.
- [9] Scarcella M. Tesla hit with 'right to repair' antitrust class actions [Internet]. London: Reuters; 2023 Mar 15 [cited 2023 May 7]. Available from: <https://www.reuters.com/legal/tesla-hit-with-right-repair-antitrust-class-actions-2023-03-15/>.
- [10] Cole C. Automakers fight updated Massachusetts 'right to repair' law [Internet]. San Francisco: CNET; 2020 Dec 1 [cited 2023 May 7]. Available from: <https://www.cnet.com/roadshow/news/automakers-fight-updated-massachusetts-right-to-repair-law/>.
- [11] Patel N. John Deere turned tractors into computers. What's next? [Internet]. New York City: The Verge; 2021 Jun 15 [cited 2023 May 7]. Available from: <https://www.theverge.com/22533735/john-deere-cto-hindman-decoder-interview-right-to-repair-tractors>.
- [12] Luccio M, Schrock G. Precision agriculture: GNSS is now standard on most tractors [Internet]. Cleveland: GPS World; 2023 Jan 25 [cited 2023 May 7]. Available from: <https://www.gpsworld.com/precision-agriculture-gnss-is-now-standard-on-most-tractors/>.
- [13] Woods B. How John Deere plans to build a world of fully autonomous farming by 2030 [Internet]. New York City: CNBC; 2022 Oct 4 [cited 2023 May 7]. Available from: <https://www.cnbc.com/2022/10/02/how-deere-plans-to-build-a-world-of-fully-autonomous-farming-by-2030.html>.
- [14] Silverberg D. Lasers, drones, and AI: the future of weeding [Internet]. London: BBC News; 2023 Feb 27 [cited 2023 May 1]. Available from: <https://www.bbc.com/news/business-64742513>.
- [15] Savage S. Farm with a view: how drone technology is taking agriculture to a new level [Internet]. New York City: Forbes; 2023 Feb 23 [cited 2023 May 7]. Available from: <https://www.forbes.com/sites/stevensavage/2023/02/23/farm-with-a-view-how-drone-technology-is-taking-agriculture-to-a-new-level>.
- [16] Chen BX. How Apple is screwing your iPhone [Internet]. San Francisco: Wired; 2011 Jan 28 [cited 2023 May 7]. Available from: <https://www.wired.com/2011/01/apple-is-screwing-your-iphone/>.
- [17] Klosowski T. What you should know about right to repair [Internet]. New York City: New York Times; 2021 Jul 15 [cited 2023 May 7]. Available from: <https://www.nytimes.com/wirecutter/blog/what-is-right-to-repair/>.
- [18] Roth E. John Deere commits to letting farmers repair their own tractors (kind of) [Internet]. New York City: The Verge; 2023 Jan 9 [cited 2023 May 7]. Available from: <https://www.theverge.com/2023/1/9/23546323/john-deere-right-to-repair-tractors-agreement>.
- [19] Newman LH. A new jailbreak for John Deere tractors rides the right-to-repair wave [Internet]. San Francisco: Wired; 2022 Aug 13 [cited 2023 May 7]. Available from: <https://www.wired.com/story/john-deere-tractor-jailbreak-defcon-2022/>.
- [20] Andrada TK. iPhone 14 repairs are easier, but Apple's strict 'Parts Pairing' policy may upset you [Internet]. New York City: Tech Times; 2022 Oct 28 [cited 2023 May 7]. Available from: <https://www.techtimes.com/articles/282612/20221028/iphone-14-repairs-easier-apples-strict-parts-pairing-policy-upset.htm>.
- [21] Chen BX. I tried Apple's Self-Repair program with my iPhone. Disaster ensued [Internet]. New York City: The New York Times; 2022 May 25 [cited 2023 May 7]. Available from: <https://www.nytimes.com/2022/05/25/technology/personaltech/apple-repair-program-iphone.html>.
- [22] Memorandum of understanding [Internet]. Washington, DC: American Farm Bureau Federation; 2023 Jan 8 [cited 2023 May 7]. Available from: [https://www.fb.org/files/AFBF\\_John\\_Deere\\_MOU.pdf](https://www.fb.org/files/AFBF_John_Deere_MOU.pdf).
- [23] Brown M. Right to repair notches a big win in Colorado [Internet]. Arlington: Politico; 2023 Apr 27 [cited 2023 May 7]. Available from: <https://www.politico.com/newsletters/the-long-game/2023/04/27/right-to-repair-notches-a-big-win-in-colorado-00094022>.
- [24] O'Neill S. Europe puts teeth in right to repair. *Engineering* 2021;7(9): 1197–8.
- [25] Lomas N. Europe tools up for a repairable future [Internet]. San Francisco: TechCrunch; 2023 Mar 22 [cited 2023 May 7]. Available from: <https://techcrunch.com/2023/03/22/eu-right-to-repair/>.
- [26] Motor vehicle information scheme (MVIS) [Internet]. Canberra: Australian Competition & Consumer Commission; [cited 2023 May 7]. Available from: <https://www.accc.gov.au/by-industry/cars-and-vehicles/motor-vehicle-information-scheme-mvis>.
- [27] Chen J, Yang L, Zhu C. Right to repair: pricing, welfare, and environmental implications. *Manage Sci* 2023;69(2):1017–36.