PitchBook

EMERGING TECH RESEARCH

Agtech Report

VC trends and innovation spotlights

Q2
2024

Contents

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Institutional Research Group

Analysis

Alex Frederick Senior Analyst, Emerging Technology
alex.frederick@pitchbook.com
pbinstitutionalresearch@pitchbook.com

Ben Riccio Associate Analyst, Emerging Technology
ben.riccio@pitchbook.com
pbinstitutionalresearch@pitchbook.com

Data

Matthew Nacionales Senior Data Analyst

Publishing

Report designed by **Chloe Ladwig** and **Julia Midkiff**

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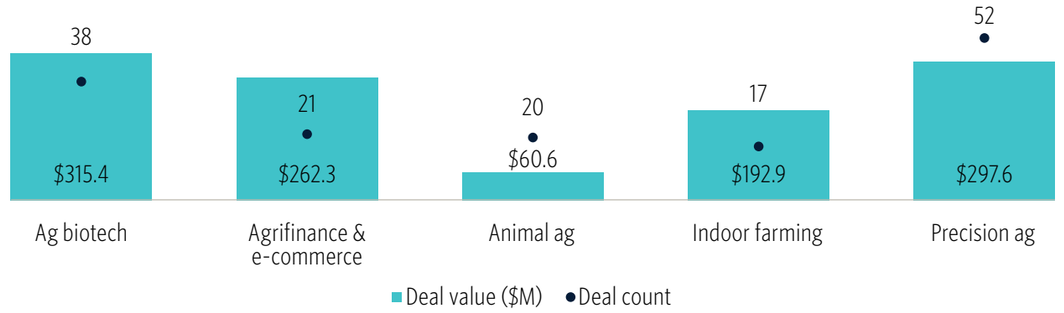
For previous updates as well as our complete agtech research, please see the designated analyst workspace on the PitchBook Platform.

Vertical update

As of mid-2024, the agriculture technology (agtech) investment landscape presents a complex picture shaped by various macroeconomic factors and sector-specific developments. While moderate global economic growth continues to support investment sentiment, persistent inflation has kept interest rates high in many economies, potentially constraining capital. Agricultural commodity prices remain volatile due to climate events and geopolitical tensions, underscoring the need for innovative solutions.

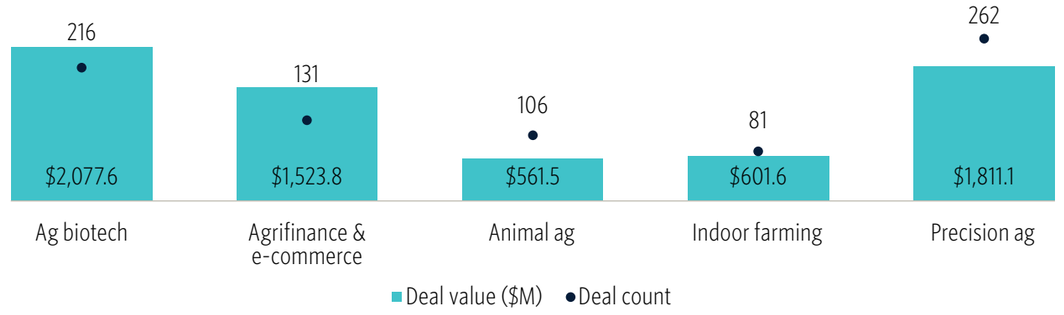
These challenges have catalyzed significant advancements in the agtech sector. Extreme weather events, particularly severe droughts, have accelerated the adoption of climate-resilient technologies such as drought-resistant crops and advanced irrigation systems. The focus on sustainability has spurred investment in carbon-reducing initiatives, including methane-reducing feed additives for livestock and carbon-credit markets for regenerative farming. Breakthroughs in gene editing, especially CRISPR applications for crop resilience, have attracted both interest and debate. The integration of 5G in rural areas has enhanced Internet of Things (IoT) applications in farming, improving real-time data collection and analysis. Rising costs of synthetic fertilizers have boosted interest in biological alternatives and precision application methods. Ongoing labor shortages have driven automation advancements, including autonomous tractors and harvesting robots. Despite challenges, the critical role of agtech in addressing global food production and sustainability issues continues to attract investment and drive innovation.

Q2 2024 agtech VC deal activity by segment*



Source: PitchBook • Geography: Global • *As of June 30, 2024

Trailing 12-month (TTM) agtech VC deal activity by segment*



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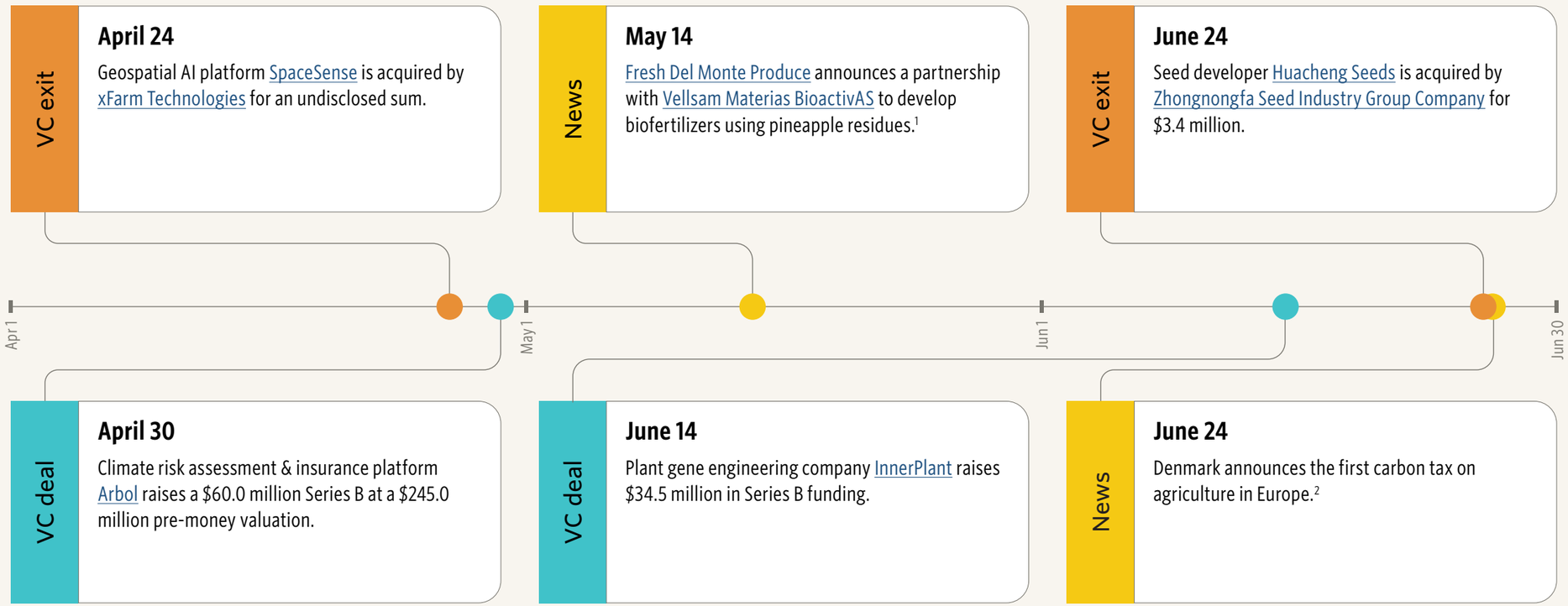
Q2 2024 timeline



Q2 VC deal activity summary

147
total deals

-26.1%
QoQ growth

$1.1B
total VC raised

-6.0%
QoQ growth

TTM VC deal activity summary

789
total deals

-32.5%
YoY growth

$6.1B
total VC raised

-37.3%
YoY growth

1: "Fresh Del Monte Announces Partnership to Produce Biofertilizers From Fruit Residues, Launching Innovative Plant in Kenya," Yahoo! Finance, Business Wire, May 14, 2024.
2: "The Government and the Parties in the Green Tripartite Enter Into the Historic Agreement on a Green Denmark" (Google translation), Regeringen, Ministry of Economy, June 24, 2024.

Agtech landscape

1. Ag biotech
2. Agrifinance & e-commerce
3. Indoor farming
4. Animal ag
5. Precision ag

Agtech VC ecosystem market map

This market map is an overview of venture-backed or growth-stage companies that have received venture capital or other notable private investments. Click to view the full map on the PitchBook Platform.

1 Ag biotech

Animal biotech

Biomaterials

Plant biotech

Plant data & analysis

2 Agrifinance & e-commerce

Agribusiness marketplaces

Finance & insurance

3 Indoor farming

Components

Systems

Growers

4 Animal ag

Aquaculture

Insect farming

Livestock & land animal technology

Pollination tech

5 Precision ag

Drones & imagery analytics

Farm management software

Field IoT

Robotics & smart field equipment

VC activity

Agtech VC activity continued to be muted in Q2 2024. We logged $1.1 billion invested across 147 deals. Deal values were roughly on par with the prior quarter. However, deal counts continued the steady slide downward. Annually, deal values and counts are projected to end 2024 down 42.4% and 30.7%, respectively, compared with the prior year.

Despite sluggish activity within the vertical, four subsegments were of particular interest to investors in Q2. Ag finance & insurance companies raised $104.5 million across nine deals, up 49.6% and 12.5%, respectively. Arbol, developer of a climate risk assessment & insurance platform, raised the bulk of capital with a $60.0 million Series B at a $245.0 million pre-money valuation.

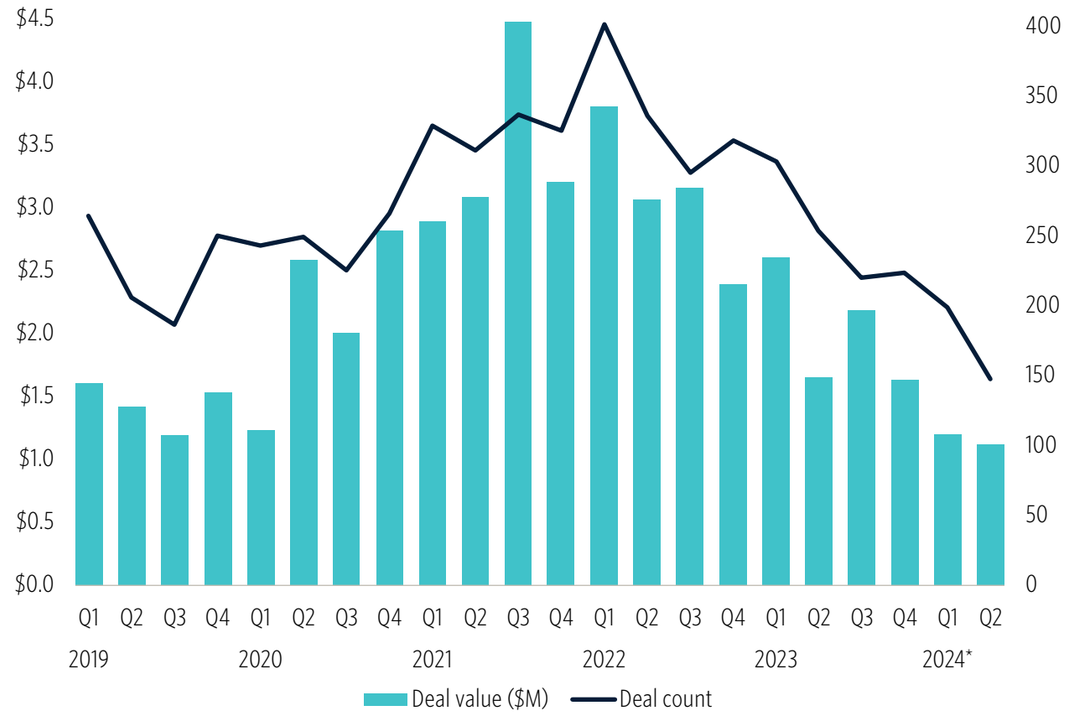
Companies in livestock & land animal technology raised a cumulative $29.1 million across 12 deals in Q2, essentially on par with the prior quarter. Of this total, AgriWebb raised $11.0 million in late-stage VC funding. The company develops livestock management software for ranch mapping, inventory management, and task management.

Drones & imagery analytics raised $96.3 million across 10 deals in Q2. Startup Synspective raised $44.6 million in Series C funding. The company provides satellite data and remote monitoring services for a variety of user types and use cases, including forest inventory management for decarbonization and forest preservation.

Robotics & smart field equipment raised $115.5 million across 19 deals. Deal count has remained flat in this subsegment over the past five quarters. Startup Ecozen raised $30.0 million in late-stage VC funding. The company makes agtech hardware for smallholder farmers in emerging markets, including a solar-powered irrigation pump controller and a solar cold-storage room.

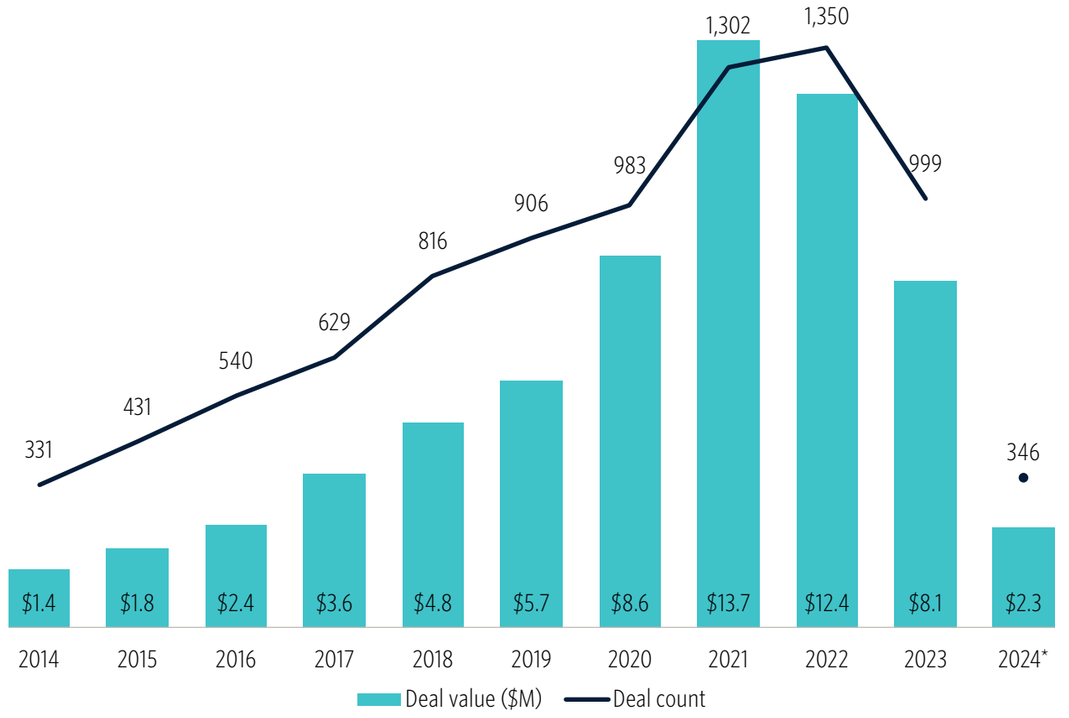
Across agtech subsegments, valuations have bifurcated by stage. Pre-money valuations at the early and venture-growth stages declined 15.5% and 69.4%, respectively, from 2023. However, pre-seed and late-stage pre-money valuations increased 45.8% and 62.9% over the same time frame. Overall, the median agtech VC pre-money valuation totaled $12.8 million at the end of Q2, down 14.0% from 2023. This decline aligns with reports of a market correction in valuations, accompanied by increased flat and down rounds.

Agtech VC deal activity by quarter



Source: PitchBook • Geography: Global • *As of June 30, 2024

Agtech VC deal activity



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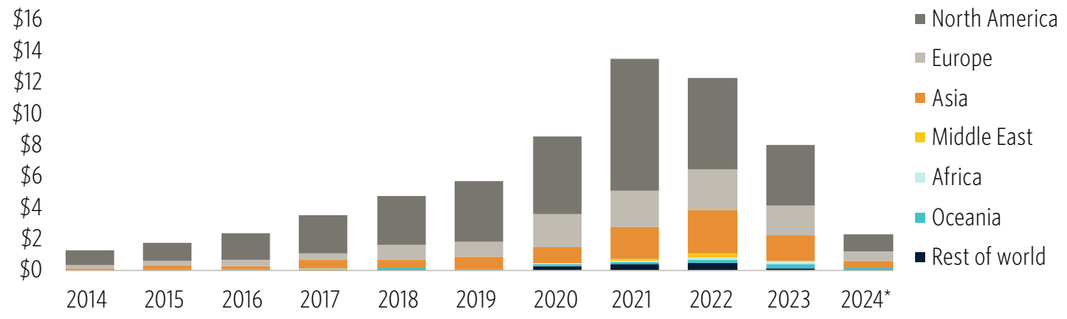
Agtech VC deal value ($B) by region



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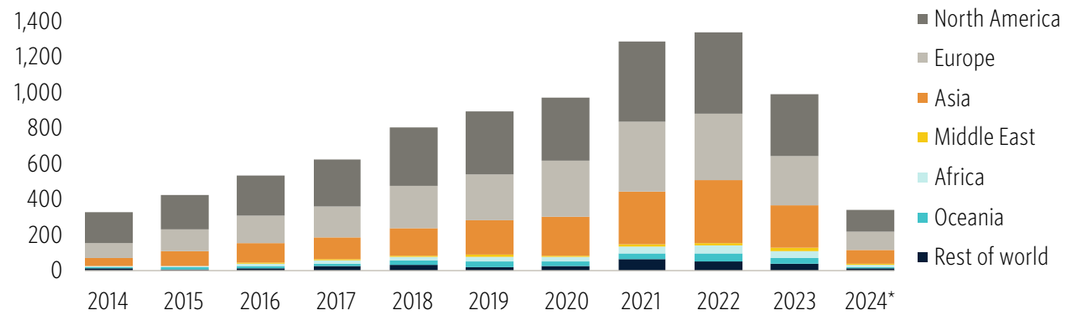
Agtech VC deal count by region



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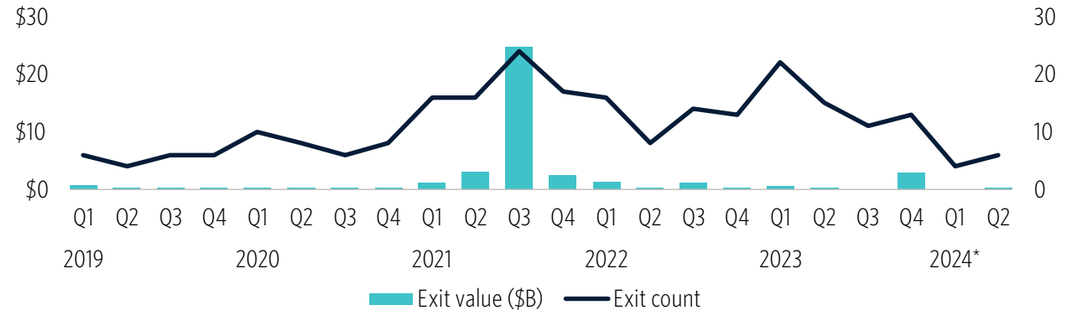
Agtech VC exit activity by quarter



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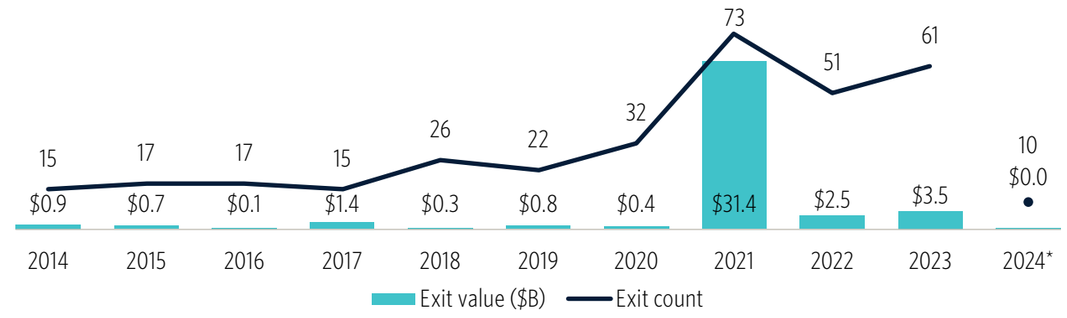
Agtech VC exit activity



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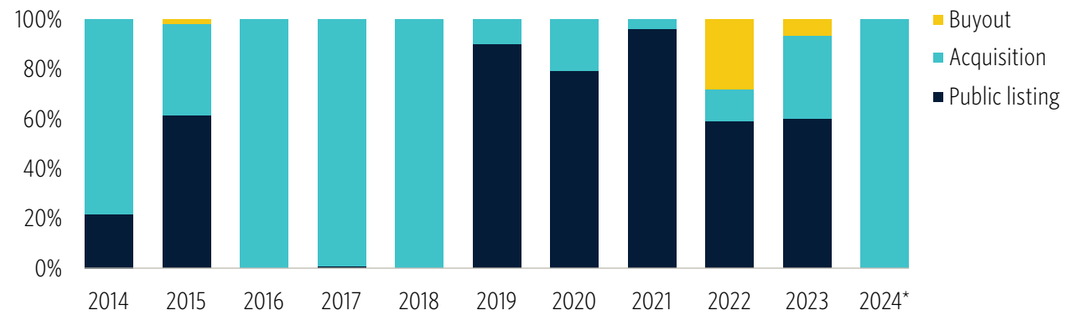
Share of agtech VC exit value by type



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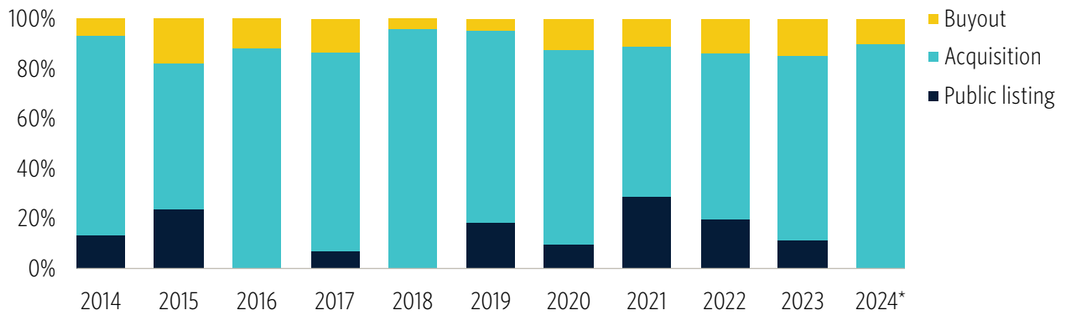
Share of agtech VC exit count by type



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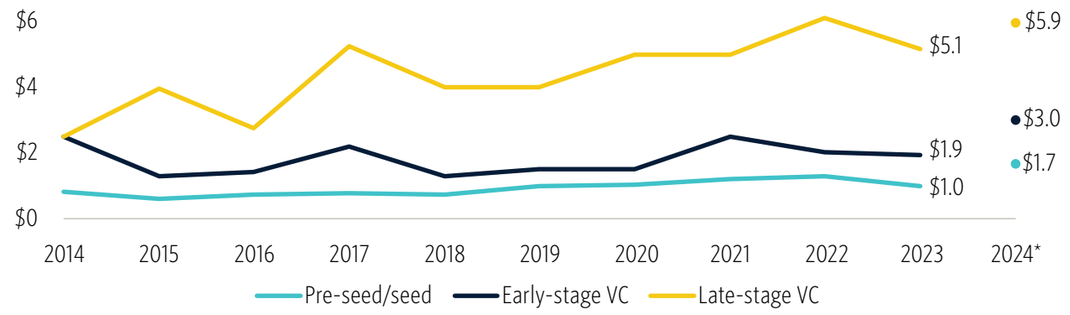
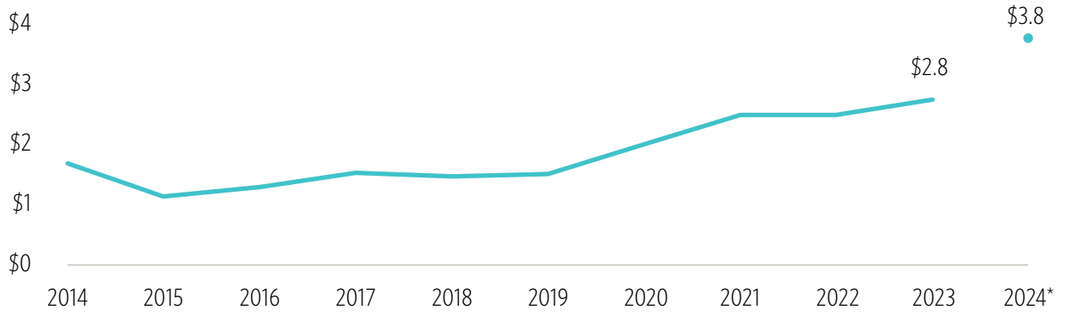
Median agtech VC deal value ($M) by stage



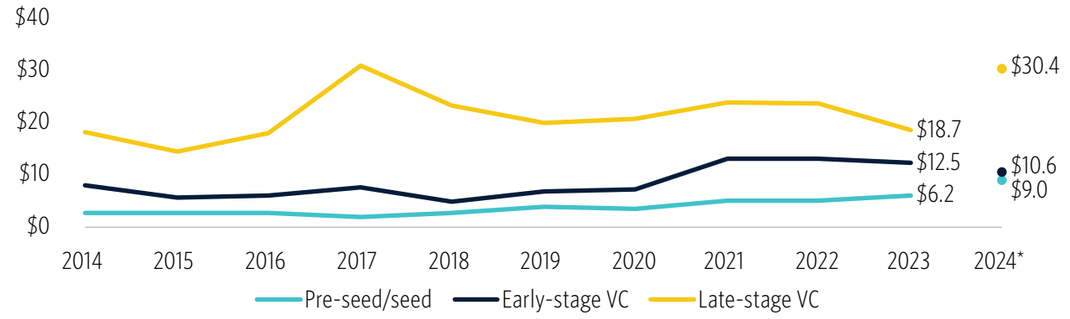
Source: PitchBook • Geography: Global • *As of June 30, 2024

Median agtech VC deal value ($M)



Source: PitchBook • Geography: Global • *As of June 30, 2024

Median agtech VC pre-money valuation ($M) by stage



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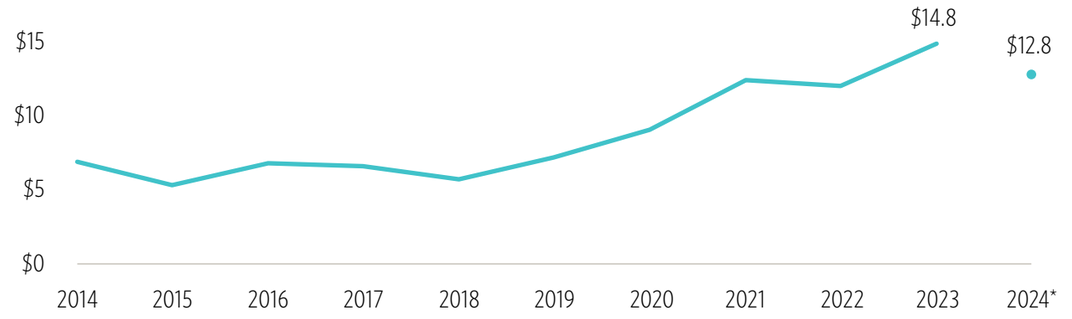
Median agtech VC pre-money valuation ($M)



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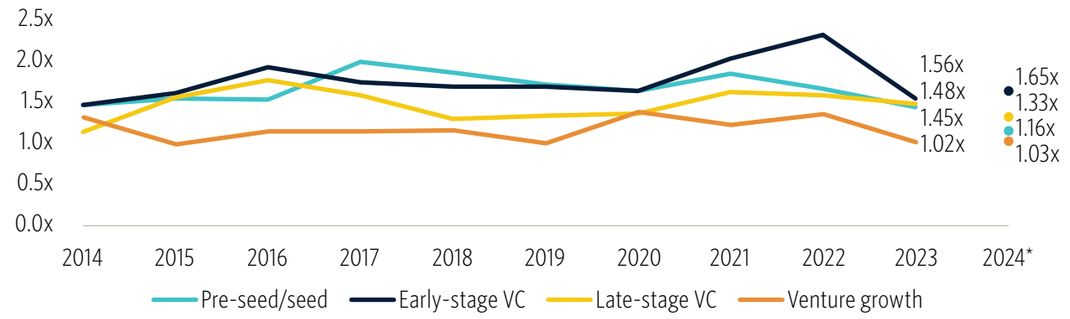
Median agtech VC pre-money valuation step-up by stage



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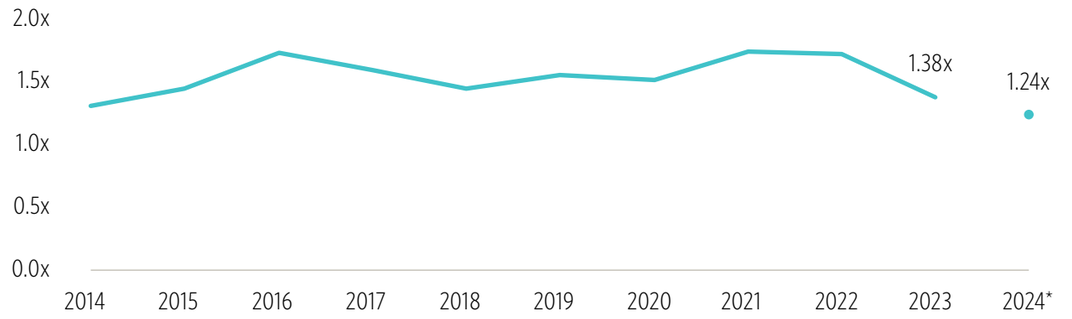
Median agtech VC pre-money valuation step-up



Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech pre-seed and seed deals in Q2 2024*

Company	Close date	Subsegment	Stage	Deal value ($M)	Post-money valuation ($M)	Lead investor(s)
Lumo	May 14	Robotics & smart field equipment	Series 1	$7.0	$25.0	Active Impact Investments, Fall Line Capital
Think Bioscience	May 6	Plant data & analysis	Seed	$6.0	N/A	N/A
Shamba Records	May 15	Farm management software	Seed	$5.0	$15.0	N/A
Soiltech Wireless	April 22	Field IoT	Seed	$4.6	$16.2	Homegrown Capital
Perlumi	June 11	Plant biotech	Seed	$4.5	$13.5	N/A
Genvax Technologies	June 24	Animal biotech	Seed	$3.4	N/A	N/A
Scout	April 9	Farm management software	Seed	$3.0	$12.0	N/A
Agriful Software	May 3	Farm management software	Seed	$3.0	$16.0	N/A
Optimal	April 23	Growers	Series 2	$2.6	$8.9	N/A
Deep Planet	April 5	Drones & imagery analytics	Seed	$2.6	$7.2	N/A

Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech early-stage VC deals in Q2 2024*

Company	Close date	Subsegment	Stage	Deal value ($M)	Post-money valuation ($M)	Lead investor(s)
Windfall Bio	April 8	Plant biotech	Series A	$28.0	N/A	Prelude Ventures
5Metis	April 12	Plant data & analysis	Series A	$15.5	$30.0	N/A
Rize	May 9	Farm management software	Series A	$14.0	N/A	Breakthrough Energy, GenZero, Temasek Holdings, Wavemaker Impact
Avalo	May 1	Plant biotech	Series A1	$12.0	$35.0	N/A
Traction	April 29	Farm management software	Series A	$10.9	N/A	Cooperative Ventures
Peptobiotics	April 5	Animal biotech	Series A	$8.4	$19.7	HATCH
Seederal	April 25	Robotics & smart field equipment	Early-stage VC	$7.6	N/A	Supernova Invest
Clean Crop Technologies	May 28	Plant biotech	Early-stage VC	$6.0	N/A	N/A
Downforce Technologies	June 13	Drones & imagery analytics	Early-stage VC	$4.2	$14.8	Equator VC
Earthshot Labs	May 10	Finance & insurance	Series A	$4.0	$17.0	N/A

Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech late-stage VC deals in Q2 2024*

Company	Close date	Subsegment	Stage	Deal value ($M)	Post-money valuation ($M)	Lead investor(s)
Oishii	June 4	Growers	Series B	$144.0	$544.0	Nippon Telegraph & Telephone
Arbol	April 30	Finance & insurance	Series B	$60.0	$305.0	Giant Ventures, Opera Tech Ventures
Agreena	May 13	Agribusiness marketplaces	Series B	$53.4	$166.7	HV Capital
Synspective	June 20	Drones & imagery analytics	Series C	$44.6	N/A	Japan Growth Capital Investment Corporation
Micropep Technologies	June 1	Plant biotech	Series B	$37.9	N/A	N/A
InnerPlant	June 14	Plant data & analysis	Series B	$34.5	$133.3	N/A
Ecozen	April 19	Robotics & smart field equipment	Late-stage VC	$30.0	N/A	Nuveen
LiveEO	June 25	Drones & imagery analytics	Series B	$27.0	N/A	DeepTech & Climate Fonds, NordicNinja VC
Nihon Agri	May 30	Agribusiness marketplaces	Series C	$27.0	$91.3	N/A
Enifer	May 23	Animal biotech	Series B	$25.9	N/A	Taaleri Bioindustry

Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech venture-growth deals in Q2 2024*

Company	Close date	Subsegment	Stage	Deal value ($M)	Post-money valuation ($M)	Lead investor(s)
Vive Crop Protection	May 23	Plant biotech	Series C	$34.4	N/A	Conexus Venture Capital Fund
Manus Bio	May 14	Biomaterials	Late-stage VC	$32.5	N/A	N/A
Frubana	May 24	Agribusiness marketplaces	Series D	$30.1	N/A	N/A
Understory	April 17	Finance & insurance	Series A	$15.0	$45.0	Prelude Ventures, True Ventures
AgriWebb	May 6	Livestock & land animal technology	Late-stage VC	$11.0	N/A	N/A
SwarmFarm Robotics	April 1	Robotics & smart field equipment	Series A1	$7.9	N/A	N/A
Farmnote	April 19	Livestock & land animal technology	Late-stage VC	$5.5	N/A	N/A
UbiQD	June 14	Components	Series B	$5.4	$55.4	N/A
AeroFarms	April 24	Growers	Series B1	$5.0	N/A	N/A
Dogtooth	April 15	Robotics & smart field equipment	Late-stage VC	$4.6	$26.6	N/A

Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech VC exits in H1 2024*

Company	Close date	Subsegment	Exit value ($M)	Exit type	Post-money valuation ($M)	Acquirer
Huacheng Seeds	June 24	Agribusiness marketplaces	$3.4	Acquisition	$9.8	Zhongnongfa Seed Industry Group Company
Smallhold	February 7	Growers	N/A	Acquisition	N/A	Monomyth Group
CattleEye	March 13	Livestock & land animal technology	N/A	Acquisition	N/A	GEA Group
SpaceSense	April 24	Drones & imagery analytics	N/A	Acquisition	N/A	xFarm Technologies
A de Agro	June 11	Finance & insurance	N/A	Acquisition	N/A	Sette.ag
BRI	March 5	Livestock & land animal technology	N/A	Acquisition	N/A	Novus International
Scanopy	May 13	Drones & imagery analytics	N/A	Acquisition	N/A	Abelio
YASAI	June 18	Growers	N/A	Acquisition	N/A	GreenState
Scout Bio	January 25	Animal biotech	N/A	Buyout	N/A	Ceva Sante Animale
Orbital Insight	May 6	Drones & imagery analytics	N/A	Acquisition	N/A	Privateer

Source: PitchBook • Geography: Global • *As of June 30, 2024

Key agtech incumbents in Q2 2024*

Company	Subsegment	Key product(s)	EV/NTM revenue	EV/NTM EBITDA
CNH Industrial	Robotics & smart field equipment	Tractors	1.8x	15.2x
John Deere	Robotics & smart field equipment	Tractors, sprayers, planters	3.6x	15.1x
Archer Daniels Midland	Livestock & land animal technology	Feed, feed additives, premix, macroingredients	0.4x	7.8x
Zoetis	Animal biotech	Vaccines, parasite control products, antibiotics	9.2x	21.8x
Hydrofarm	Components	Nutrients, grow media, containers, lighting, atmospheric control	0.9x	58.5x
Benson Hill	Plant biotech	Phenotyping, predictive breeding, environmental modeling	0.8x	N/A
Corteva	Plant biotech	Seeds & traits, crop protection, biologicals, digital tools	2.3x	11.4x
Nutrien	Plant biotech	Fertilizer, feed	1.4x	6.8x
Flying Spark	Insect farming	Protein powder, aquaculture feed	N/A	N/A
Bioceres Crop Solutions	Plant biotech	Crop protection, crop nutrition, seed & integrated products	1.7x	8.4x

Source: PitchBook • Geography: Global • *As of June 30, 2024

Top pre-seed and seed VC-backed agtech companies by total VC raised to date*

Company	VC ($M) raised to date	Most recent post-money valuation ($M)	Subsegment(s)	IPO probability	M&A probability	No exit probability
SemiosBio Technologies	$180.5	$789.6	Plant biotech, Field IoT	30%	66%	4%
Greeneye Technology	$64.6	N/A	Robotics & smart field equipment	23%	68%	9%
Mootral	$45.9	$88.0	Animal biotech	6%	50%	44%
Agtonomy	$45.0	$62.5	Robotics & smart field equipment	13%	67%	20%
constellr	$33.8	N/A	Drones & imagery analytics	3%	76%	21%
Iterro Life Sciences	$33.3	N/A	Aquaculture	1%	7%	92%
SPREAD	$29.3	$72.1	Growers	N/A	N/A	N/A
Pursell	$25.2	N/A	Plant biotech	5%	34%	61%
PredaSAR	$25.0	$90.0	Drones & imagery analytics	N/A	N/A	N/A
Think Bioscience	$23.0	$32.9	Plant data & analysis	3%	80%	17%

Source: PitchBook • Geography: Global • *As of June 30, 2024
Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Top early-stage VC-backed agtech companies by total VC raised to date*

Company	VC ($M) raised to date	Most recent post-money valuation ($M)	Subsegment	IPO probability	M&A probability	No exit probability
Plant-Ag	$800.0	$9,000.0	Growers	N/A	N/A	N/A
Zhongxin Breeding	$338.7	$1,230.8	Animal biotech	N/A	N/A	N/A
Atlas Agro	$333.0	N/A	Plant biotech	37%	36%	27%
Colossal Laboratories & Biosciences	$230.0	$1,450.0	Animal biotech	72%	23%	5%
Re:Ocean	$222.3	$6.1	Aquaculture	13%	26%	61%
Synspective	$163.1	$284.6	Drones & imagery analytics	42%	49%	9%
Maihuolang Information Technology	$150.0	N/A	Agribusiness marketplaces	N/A	N/A	N/A
Evozyne	$135.2	$310.0	Biomaterials	79%	10%	11%
FJ Dynamics	$130.9	N/A	Robotics & smart field equipment	N/A	N/A	N/A
Albedo	$124.5	$179.4	Drones & imagery analytics	35%	57%	8%

Source: PitchBook • Geography: Global • *As of June 30, 2024

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Top late-stage VC-backed agtech companies by total VC raised to date*

Company	VC ($M) raised to date	Most recent post-money valuation ($M)	Subsegment	IPO probability	M&A probability	No exit probability
Solugen	$637.8	$2,175.0	Biomaterials	88%	5%	7%
Pivot Bio	$622.0	$1,700.0	Plant biotech	13%	46%	41%
EcoCeres	$508.0	$2,400.0	Biomaterials	60%	24%	16%
InnovaFeed	$479.3	N/A	Insect farming	58%	40%	2%
Little Leaf Farms	$410.0	N/A	Growers	53%	40%	7%
Ninjacart	$362.8	$756.8	Agribusiness marketplaces	22%	53%	25%
Pure Harvest Smart Farms	$334.3	N/A	Growers	40%	48%	12%
DNA Script	$294.0	$659.7	Plant biotech	84%	14%	2%
Bluepha	$277.4	$24.1	Biomaterials	N/A	N/A	N/A
RWDC Industries	$263.1	N/A	Biomaterials	10%	25%	65%

Source: PitchBook • Geography: Global • *As of June 30, 2024

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Top venture-growth VC-backed agtech companies by total VC raised to date*

Company	VC ($M) raised to date	Most recent post-money valuation ($M)	Subsegment(s)	IPO probability	M&A probability	No exit probability
Indigo	$1,951.6	$3,950.0	Plant biotech, agribusiness marketplaces	97%	1%	2%
Farmers Business Network	$1,074.2	$3,800.0	Agribusiness marketplaces, finance & insurance, farm management software	63%	35%	2%
Plenty	$941.0	$1,900.0	Growers	89%	9%	2%
Enerkem	$893.9	N/A	Biomaterials	33%	15%	52%
Apeel	$665.0	$2,450.0	Plant biotech	95%	3%	2%
Ynsect	$583.4	$747.5	Insect farming	69%	29%	2%
Bowery	$583.1	$943.8	Growers	81%	11%	8%
Inari	$579.0	$1,650.0	Plant biotech	92%	5%	3%
Bolt Threads	$467.4	$1,200.0	Biomaterials	86%	4%	10%
eFishery	$463.4	$1,422.7	Aquaculture	92%	4%	4%

Source: PitchBook • Geography: Global • *As of June 30, 2024

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Most active investors in agtech accelerator deals in 2024*

Investor	HQ location	Deal count
Plug and Play Tech Center	Sunnyvale, US	17
Thrive by SVG Ventures	Los Gatos, US	9
Fresh Field Catalyst Accelerator	Newark, US	7
Techstars	New York, US	7
MeitY Startup Hub	New Delhi, India	6
StartLife	Wageningen, Netherlands	5
Cultivator	Regina, Canada	5
GROW Accelerator	Singapore, Singapore	5
The World Economic Forum	Geneva, Switzerland	4
Carbon13	Cambridge, UK	4

Source: PitchBook • Geography: Global • *As of June 30, 2024

Top VC investors in agtech companies since 2023*

Investor	Deal count	Pre-seed/seed	Early-stage VC	Late-stage VC	Venture growth	Investor type
SOSV	20	12	2	6	0	VC
Climate Capital	15	6	6	2	1	VC
S2G Ventures	13	1	1	7	4	VC
AgFunder	12	5	4	3	0	VC
Yield Lab	12	0	5	7	0	VC
European Innovation Council Fund	12	1	2	9	0	VC
Ag Ventures Alliance	11	4	4	2	1	VC
Serra Ventures	11	2	0	8	1	VC
Ponderosa Ventures	10	7	3	0	0	VC
Thrive by SVG Ventures	10	3	2	5	0	VC
Antler	10	10	0	0	0	VC

Source: PitchBook • Geography: Global • *As of June 30, 2024

Top PE investors in agtech companies since 2021*

Investor	Deal count	Primary investor type
Unigrains	9	PE/buyout
Sofina	7	Growth/expansion
Sofiproteol	7	PE/buyout
HarbourVest Partners	7	PE/buyout
The Carlyle Group	5	PE/buyout
Mérieux Equity Partners	4	PE/buyout
Hellman & Friedman	4	PE/buyout
Altas Partners	4	PE/buyout
Paine Schwartz Partners	4	PE/buyout
AlpInvest Partners	4	PE/buyout

Source: PitchBook • Geography: Global • *As of June 30, 2024

Top strategic acquirers of agtech companies since 2021*

Investor	Deal count	Investor type
Deveron	8	Corporation
CNH Industrial	6	Corporation
Hydrofarm	5	Corporation
xFarm Technologies	5	VC-backed company
BioFirst Group	5	PE-backed company
De Sangosse	4	PE-backed company
GrowGeneration	4	Corporation
Datamars	4	PE-backed company
John Deere	4	Corporation
Ever.ag	4	PE-backed company

Source: PitchBook • Geography: Global • *As of June 30, 2024

Innovation spotlights

Agriculture drones

Agriculture drones (ag drones) offer a low-carbon, cost-effective alternative through precision agriculture.

Gene editing

The key to future-ready crops and livestock lies in gene editing.

Agriculture drones

Overview

Ag drones are unmanned aerial vehicles (UAVs) designed for agricultural applications such as crop monitoring, spraying, mapping, and analysis. These drones are revolutionizing precision agriculture by providing high-resolution aerial imagery, real-time data, and efficient spraying capabilities, thereby enhancing productivity and reducing costs.

Remote-controlled aircraft and UAVs have been tested for agricultural applications since the 1980s. However, interest in drone technology for precision agriculture has increased rapidly since the late 2000s.

Widespread commercial adoption of drones in agriculture began in the mid-2010s as regulations began to catch up with technology and more affordable, user-friendly drones became available. In 2013, DJI launched the Phantom, one of the earliest user-friendly drones. In 2015, the Federal Aviation Administration (FAA) began granting hundreds of exemptions for agricultural drone use under Section 333 of the FAA Modernization and Reform Act of 2012. That same year, DJI launched its first crop-spraying agriculture drone. Today, DJI dominates the US ag-spray drone market with over 80% market share.[3] However, ag spraying is not the only use case for ag drones.

Use cases

- **Crop monitoring and health assessment:** Drones equipped with multispectral and thermal sensors can detect crop health issues, such as disease, pest infestations, and water stress, before they become visible to the naked eye.
- **Field mapping and surveying:** High-resolution aerial imagery allows for accurate mapping of fields, identifying variations in soil and crop conditions, and creating detailed topographic maps for better farm management.
- **Precision spraying:** Drones can apply fertilizers, pesticides, and herbicides with high precision, reducing the amount of chemicals used and minimizing environmental impact.
- **Planting and seeding:** Some drones can plant seeds in hard-to-reach or uneven terrain, offering a faster and more efficient alternative to traditional methods.
- **Livestock monitoring:** Drones can monitor the health and location of livestock, providing valuable data to farmers to ensure the well-being of their animals.

Startups leading the disruption

Several startups are at the forefront of disrupting the ag drone market with innovative solutions for various use cases. DJI, a market leader, is renowned for its advanced ag drones, like the Agras series, which excels in precision spraying and mapping. Similarly, Rantizo specializes in drone-based ag-spraying solutions, offering efficient and targeted application of crop inputs that significantly reduce the need for traditional labor-intensive methods. Xaircraft also focuses on precision spraying, providing drones that optimize pesticide and fertilizer application to enhance crop yields. Pyka, on the other hand, is pioneering autonomous electric aircraft for agricultural use, concentrating on large-scale crop spraying with minimal environmental impact.

For data collection and analysis, DroneDeploy provides robust software solutions for drone mapping and analysis, enabling farmers to generate detailed maps and actionable insights from aerial data. EAVision Robot integrates advanced computer vision technology into its drones,

3: "Ag Drone Distributors Form Coalition to Fight Moves to Block DJI Drones in US Market," AgFunderNews, Elaine Watson, July 16, 2024.

allowing for precise monitoring and management of crop health and field conditions. Wingtra offers fixed-wing drones that combine the advantages of vertical takeoff and landing with long-range flight capabilities, which is ideal for large-scale field mapping and surveying.

Challenges and opportunities

The ag drone market faces several significant challenges. Regulatory hurdles are a primary concern, as stringent regulations and certification requirements for drone operations can hinder widespread adoption, particularly in countries with strict airspace control. A recent US House defense bill amendment threatens to block DJI from obtaining Federal Communications Commission licenses for future models and potentially revoke existing authorizations. The Senate's version of the bill, however, does not include these restrictions, leaving the outcome uncertain. Ag drone distributors—including Pegasus Robotics, Rantizo, Bestway Ag, DroneNerds, HSE-UAV, and Agri Spray Drones—formed a coalition to oppose these legislative efforts, lobbying Congress and emphasizing the significant negative impact on the agricultural sector if DJI is banned.

Additionally, managing and analyzing the vast amounts of data collected by drones necessitates robust software and data management systems, which can be a barrier for smaller farms lacking the necessary infrastructure. The high initial investment required to acquire and maintain drones is another obstacle, especially for small-to-midsized farmers, despite the potential long-term benefits.

Moreover, effective use of drones demands technical knowledge and skills, requiring farmers and farm workers to undergo training and education. Lastly, drone operations can be heavily affected by adverse weather conditions, limiting their usability in certain regions or seasons.

Despite these challenges, the ag drone market presents numerous opportunities. Drones enable precision agriculture, leading to higher crop yields, reduced input costs, and optimized resource usage, significantly increasing farm efficiency. They also reduce environmental impact by minimizing the use of chemicals and water. The scalability of drones makes them versatile tools suitable for various farm sizes, from small family farms to large commercial operations. Continued advancements in drone technology, such as AI & machine learning integration, promise even more accurate and actionable insights, enhancing its effectiveness. Furthermore, the ag drone market is expected to grow significantly, driven by increasing demand for precision agriculture and technological innovations, thus presenting substantial business opportunities for companies in this sector.

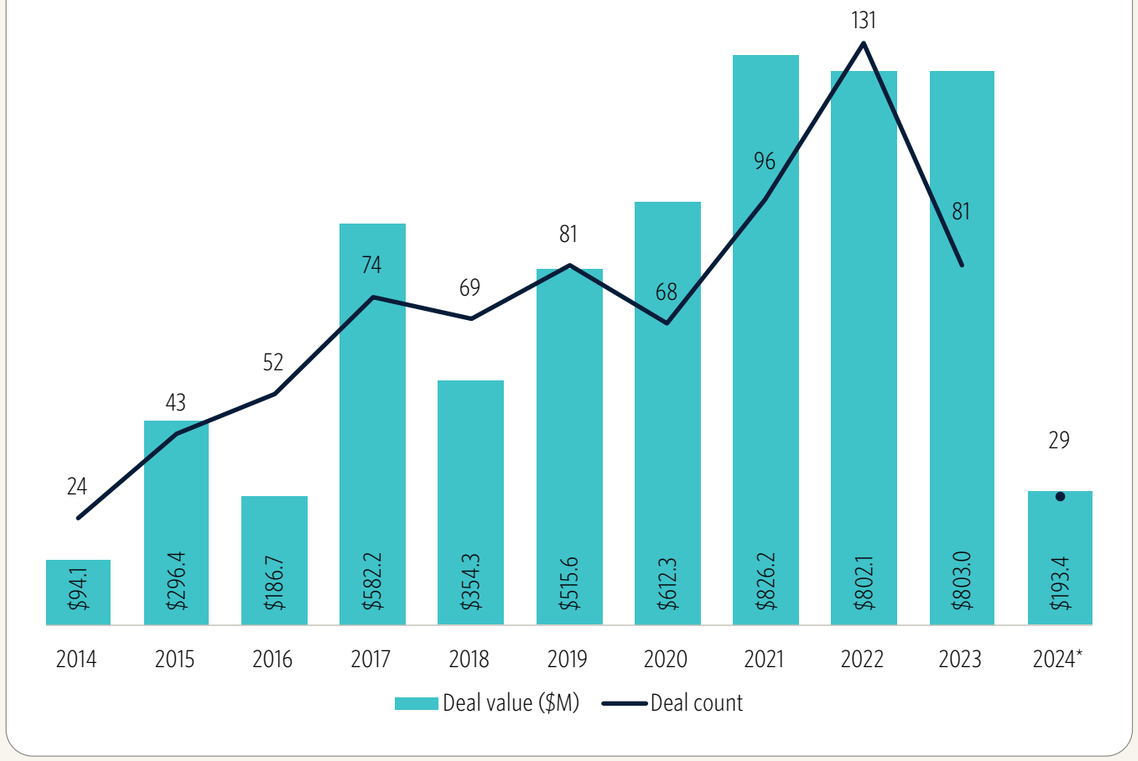
Top VC-backed ag drone companies by total VC raised to date*

Company	Key application(s)	VC ($M) raised to date	Most recent post-money valuation ($M)	IPO probability	M&A probability	No exit probability
Xaircraft	Agricultural spraying drones	$201.8	$560.7	N/A	N/A	N/A
Percepto	Autonomous inspection drones	$154.1	$210.0	13%	84%	3%
DroneDeploy	Drone mapping software	$150.0	$495.0	35%	63%	2%
Pachama	Carbon offset monitoring	$88.0	$364.0	4%	80%	16%
SeeTree	Tree monitoring drones	$86.5	$36.0	4%	55%	41%
Skycatch	Industrial mapping drones	$75.0	$100.0	6%	86%	8%
EAVision Robot	Crop monitoring drones	$62.6	$33.3	N/A	N/A	N/A
Sentera	Crop monitoring, field mapping	$55.0	N/A	14%	81%	5%
Wingtra	Mapping/surveying drones	$51.9	$147.3	4%	81%	15%
Propeller	Drone data analytics	$47.4	$225.3	12%	71%	17%

Source: PitchBook • Geography: Global • *As of June 30, 2024

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Drones & imagery analytics VC deal activity



Source: PitchBook • Geography: Global • *As of June 30, 2024

Gene editing

Overview

Gene-editing technology, particularly CRISPR-Cas9, is revolutionizing agriculture by enabling precise, efficient, and cost-effective modifications of plant and animal genomes. This technology offers the potential to address major agricultural challenges such as improving crop yields, enhancing nutritional content, increasing resistance to pests and diseases, and reducing environmental impacts. The agricultural gene-editing market is expanding rapidly, driven by advancements in biotechnology, growing demand for sustainable farming practices, and increasing investments from public and private sectors.

Use cases

Gene-editing technology offers numerous use cases in agriculture. By optimizing traits such as growth rate, photosynthetic efficiency, and nutrient utilization, gene editing can increase crop yields. Additionally, it can enhance the nutritional profile of crops, boosting essential vitamins, minerals, and proteins. This technology also introduces resistance to various pests and diseases, reducing the need for chemical pesticides and promoting healthier crops.

In livestock improvement, gene editing enhances disease resistance, reducing reliance on antibiotics and improving overall animal welfare. Modifications can also improve feed conversion efficiency and growth rates, leading to more sustainable meat production. Notably, a team of scientists at the University of California, Davis and the University of California, Berkeley recently teamed up to research whether gene editing of rumen microbes in cattle can significantly reduce methane emissions,[4] contributing to climate change mitigation by decreasing greenhouse gas emissions from livestock.

Gene editing also promotes sustainability and reduces the environmental impact of agriculture. By developing crops and livestock that are more resilient and require fewer chemical inputs, gene editing reduces environmental contamination. Furthermore, crops engineered to promote beneficial microbial communities and reduce soil erosion can enhance soil health.

Startups leading the disruption

Several startups are at the forefront of leveraging gene-editing technology to disrupt agriculture, each with unique focuses and significant achievements. Pairwise develops gene-edited fruits and vegetables that offer improved taste, nutrition, and convenience. Its work on leafy greens, for instance, aims to enhance taste and extend shelf life, addressing consumer demands for better-quality produce.

Inari is another key player, utilizing gene editing to create crops that require fewer resources while yielding higher productivity. Its research focuses primarily on staple crops like corn and soybeans, aiming to enhance environmental sustainability and crop efficiency. By addressing issues such as resource use and yield, Inari is contributing to the development of more-resilient agricultural systems.

4: “Can CRISPR Cut Methane Emissions From Cow Guts?” UC Davis, Clémentine Sicard, April 17, 2023.

Tropic Biosciences and Cibus are also making notable strides in the gene-editing landscape. Tropic Biosciences improves tropical crops like bananas, coffee, and rice, with achievements including disease-resistant banana varieties and decaffeinated coffee beans. Cibus, meanwhile, applies gene editing to develop crops with improved traits such as herbicide tolerance, disease resistance, and enhanced nutritional profiles. Its work on canola and flax aims to provide farmers with more robust and sustainable crop options. These startups exemplify the diverse applications and transformative potential of gene editing in agriculture.

Challenges and opportunities

Agricultural gene-editing technology faces several challenges. Regulatory hurdles are a significant issue, as gene-edited organisms must undergo rigorous scrutiny, delaying market entry. Public perception and concerns about the safety and ethics of gene editing further complicate regulatory approval and consumer acceptance. Additionally, navigating the complex landscape of patents and licensing agreements can be difficult for startups and researchers. High initial costs of research & development also pose economic challenges, and market adoption may be slow as farmers and producers weigh the costs and benefits of new technologies.

Despite these challenges, gene-editing technology offers numerous opportunities. It holds the potential to significantly mitigate climate change by developing crops, livestock, and inputs that reduce greenhouse gas emissions and enhance carbon sequestration. By improving crop yields and livestock productivity, gene editing can address global food security issues and combat malnutrition, especially in developing regions. The technology also supports sustainable agriculture by reducing dependency on chemical inputs and enhancing resource efficiency. Furthermore, gene editing allows for the development of crops tailored to specific regional climates and soil conditions, improving resilience and productivity. Continued investment and innovation in this field can unlock these opportunities, leading to a more sustainable and efficient agricultural sector.

Key VC-backed ag gene-editing companies by total VC raised to date*

Company	Value proposition	VC ($M) raised to date	Most recent post-money valuation ($M)	IPO probability	M&A probability	No exit probability
Pivot Bio	Nitrogen-producing microbes	$622.0	$1,700.0	13%	46%	41%
Inari	Crop yield enhancement	$579.0	$1,650.0	92%	5%	3%
AgBiome	Biological crop protection	$236.2	N/A	69%	26%	5%
Pairwise	Improved crop traits	$115.0	N/A	7%	51%	42%
Kaiima	Genetic yield improvement	$99.6	N/A	N/A	N/A	N/A
Tropic Biosciences	Enhanced crop resiliance	$75.4	$86.2	10%	82%	8%
Recombinetics	Precision animal genetics	$54.7	N/A	2%	20%	78%
Phylos	Cannabis genomics	$49.3	$16.0	25%	61%	14%
Pebble Labs	Biocontrol solutions	$34.7	$335.0	13%	43%	44%
Renaissance BioScience	Microbial fermentation technologies	$22.5	N/A	13%	39%	48%

Source: PitchBook • Geography: Global • *As of June 30, 2024
Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Select company highlights

Arbol

Overview

Arbol is an innovative parametric insurance platform providing climate risk solutions to the agriculture and energy industries. Unlike traditional insurance services that assess and cover physical losses, parametric coverage provides payouts when certain data points reach predetermined triggers. For example, the Arbol platform covers data points such as crop yield, rainfall, temperature, and wind speeds. Arbol allows farmers to mitigate the risk of unexpected weather events by providing payouts when these figures are unusually high or low. Additionally, this simplified insurance model allows for faster payouts and is more accessible to traditionally uninsured groups such as smallholder farmers, organic farmers, or specialty crop growers. Arbol has found success scaling the adoption of weather-based parametric insurance, providing coverage in 15 countries.

Leadership

Experienced professionals from diverse fields comprise Arbol's leadership team. It is led by its three founders: CEO Siddhartha Jha, his brother, Chief Data Officer Osho Jha, and President Philippe Heilberg. Siddhartha brings his experience in commodity trading and quantitative research at Citadel. Osho's background in data science, both at BlackRock and M Science, equips him to conduct Arbol's data operations. In 2020, the three founders also started dClimate, a climate data marketplace. All three hold leadership positions in both companies.

Key company information

Founded
2018

Total raised
$69.0M over three deals

Last financing
$305.0M post-money valuation as of April 2024

Employees
79+

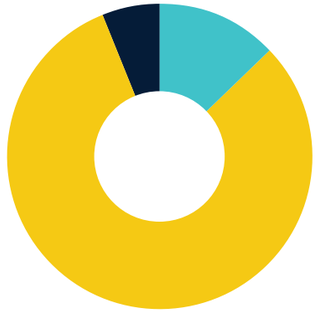
Last disclosed financing
Raised $60.0M in Series B funding

HQ location
New York, US

First disclosed institutional round
Raised $2.2M in seed funding

Lead investors
Giant Ventures, Opera Tech Ventures

Exit Predictor



IPO: 13% probability **M&A:** 81% probability **No exit:** 6% probability

Success: 94% probability

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Competitors

While still a niche market, parametric insurance has become an increasingly popular way of mitigating climate and weather-related risk. Companies like FloodFlash and Floodbase offer parametric insurance to property owners in case of floods. In the agriculture space, however, Arbol has few VC-backed competitors, with only the France-based company Descartes Underwriting offering similar parametric insurance services. This leaves Arbol to contend mainly with traditional crop and agriculture insurance providers. However, its unique platform allows Arbol to target a broader market of farmers who do not typically purchase traditional insurance.

Financing history

Seed	Series A	Series B
November 18, 2019	**January 8, 2021**	**April 30, 2024**
Total raised $2.2M	**Total raised** $6.8M	**Total raised** $60.0M
Pre-money valuation $12.5M	**Pre-money valuation** $30.0M	**Pre-money valuation** $245.0M
Lead investors Giant Ventures, Opera Tech Ventures	**Lead investor** Susquehanna International Group	**Lead investor** Finch Finance

Overview

Monarch Tractor is an agriculture robotics company increasing efficiency and sustainability in farm operations by providing autonomous tractors and management software. The company launched its fully electric tractor, the MK-V, in 2022, and has since delivered over 400 vehicles to customers across 12 states and three countries. The vehicle is driver optional and can be programmed and tracked through Monarch's field management software, WingspanAI. The software also manages all data collected by the tractor to provide a centralized platform for farm data and fleet control. By increasing efficiency and eliminating fuel costs, Monarch hopes to improve customers' profitability across various agriculture markets. In July, the company secured $133.0 million in Series C funding to increase tractor production and expand its digital solutions.

Leadership

Monarch is led by its four co-founders. CEO Praveen Penmetsa brings over 20 years of engineering experience, along with startup leadership experience through previous board seats at early-stage VC companies. Both President Mark Schwager and Chief Technology Officer Zachary Omohundro have extensive engineering and supply-chain backgrounds. Co-founder and Chief Farming Officer Carlo Mondavi brings strong agricultural experience and a deep understanding of regenerative farming practices as a fourth-generation winegrower. With agriculture and engineering experience, Monarch's leadership team is poised to create innovative products that address the needs of farmers.

Key company information

Founded
2018

Total raised
$281.5M over five deals (including debt)

Last financing
$518.0M post-money valuation as of July 2024

Employees
296

Last disclosed financing
Raised $133.0M in Series C funding

HQ location
Livermore, US

First disclosed institutional round
Raised $20.0M in Series A funding

Lead investors
Astanor Ventures, CTBC Venture Capital

Exit Predictor

IPO: 63% probability **M&A:** 17% probability **No exit:** 20% probability

Success: 80% probability

Note: Probability data is based on PitchBook VC Exit Predictor methodology.

Competitors

Tractor manufacturers have been slow to develop electric and automated models compared with other industries, leading to few market competitors for Monarch. New Holland, owned by CNH Industrial, released an autonomous electric tractor in 2022 and recently partnered with Bluewhite to bring additional autonomous tech to tractors. Other large manufacturers, such as John Deere and Massey Ferguson, are still developing electric tractor offerings. While few VC-backed companies are direct competitors, emerging autonomous farming equipment could potentially compete with Monarch's tractors. Oxin is developing an autonomous tractor-type machine for vineyards and orchards that performs many conventional tasks including towing, spraying, skirting, and trimming. Similarly, vineyard robot VitiBot is an electric, autonomous vineyard straddle robot capable of mechanical weeding, mowing, spraying, and more. Naïo Technologies produces a fleet of smaller, fully autonomous farming equipment capable of completing basic farming tasks. While these machines are more specialized than conventional tractors and cannot be manually controlled like Monarch's product, they offer similar solutions for a subset of farms looking to automate workflows.

Financing history

Series A	Series B	Series C
March 16, 2021	**November 15, 2021**	**July 22, 2024**
Total raised $20.0M	**Total raised** $61.0M	**Total raised** $133.0M
Pre-money valuation $40.0M	**Pre-money valuation** $210.0M	**Pre-money valuation** $385.0M
Lead investor Musashi Seimitsu Industry Company	**Lead investor** Astanor Ventures	**Lead investors** Astanor Ventures, CTBC Venture Capital

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PitchBook Data, Inc.

Nizar Tarhuni Executive Vice President of Research and Market Intelligence

Paul Condra Head of Emerging Technology Research

Additional research

Eric Bellomo
eric.bellomo@pitchbook.com
Gaming
E-Commerce

Brendan Burke
brendan.burke@pitchbook.com
Data Analytics
Information Security
Artificial Intelligence & Machine Learning

Aaron DeGagne
aaron.degagne@pitchbook.com
Medtech
Digital Health

Alex Frederick
alex.frederick@pitchbook.com
Agtech
Foodtech

Jonathan Geurkink
jonathan.geurkink@pitchbook.com
Supply Chain Tech
Mobility Tech

Kazi Helal
kazi.helal@pitchbook.com
Biopharma
Pharmatech

Derek Hernandez
derek.hernandez@pitchbook.com
Enterprise SaaS
Infrastructure SaaS

Ali Javaheri
ali.javaheri@pitchbook.com
Emerging Spaces

Robert Le
robert.le@pitchbook.com
Insurtech
Crypto

John MacDonagh
john.macdonagh@pitchbook.com
Carbon & Emissions Tech
Clean Energy Tech

Rebecca Springer
rebecca.springer@pitchbook.com
Healthcare Services
Healthcare IT
Pharma Services

Rudy Yang
rudy.yang@pitchbook.com
Enterprise Fintech
Retail Fintech