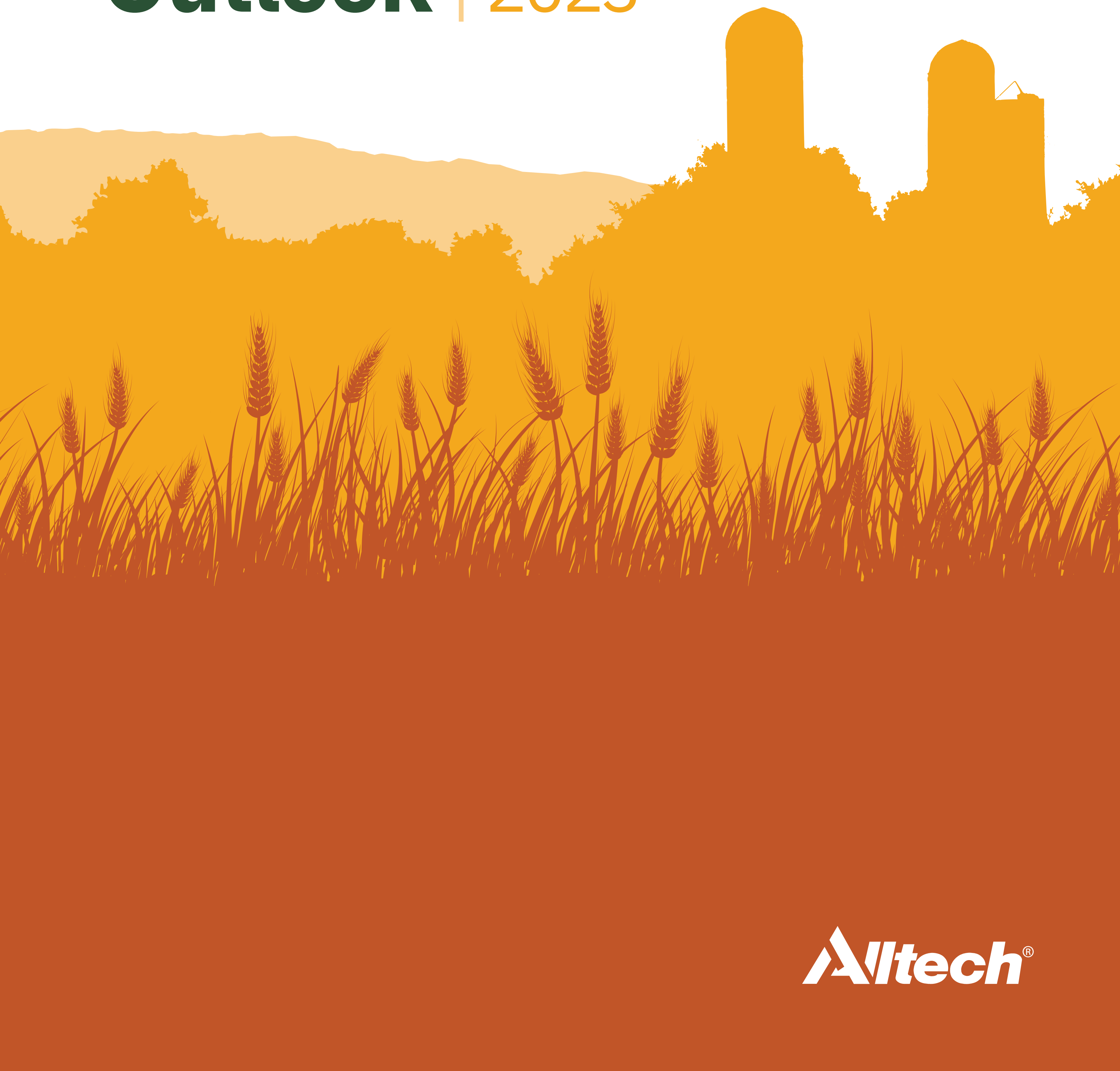
Agri-Food Outlook | 2023



Alltech®

Global Feed Production Remains Steady in 2022

Pet feed shows most significant growth while reduction in beef feed production begins to moderate

Global feed production remained steady in 2022 despite significant macroeconomic challenges that affected the entire supply chain. Europe bore the brunt of the impact, including significant disease challenges, severe weather and the impacts of the invasion of Ukraine. Alltech's Agri-Food Outlook estimates that global feed tonnage totaled 1.266 billion metric tons (BMT) in 2022, a decrease of less than one-half of one percent from 2021's estimates.

The annual survey, now in its 12th year, includes data from 142 countries and more than 28,000 feed mills. It assesses compound feed production and prices by utilizing information collected by Alltech's global sales team and in partnership with local feed associations.

The Alltech Agri-Food Outlook also offers a holistic look at the state of the industry, using answers from our corresponding qualitative survey to uncover the trends and technologies that are impacting the agri-food industry, highlight opportunities for growth and gauge expectations for 2023.

Feed production increased in several regions, including Latin America (1.6%), North America (0.88%) and Oceania (0.32%). As a result of improvements in the scale and accuracy of our sources in the Middle East, our 2022 feed production numbers were nearly 25% higher than they were in 2021. The Middle East increase is also due in part to an initiative by the Saudi Arabian government to expand broiler chicken production to meet the country's self-sufficiency goals.

Feed production in Europe decreased by 4.67% and was down by 3.86% in Africa. Production in the Asia-Pacific region also dropped 0.51%.

Globally, increases in feed tonnage were reported in the aquaculture, broiler, layer and pet food sectors, while decreases were reported in the beef, dairy and pig sectors.

Although it experienced a narrow reduction in feed production, China remains the largest feed-producing country in the world, followed by the United States and Brazil.

Consumer trends making the biggest impact on agri-food

Product prices/ the economy*

Food security

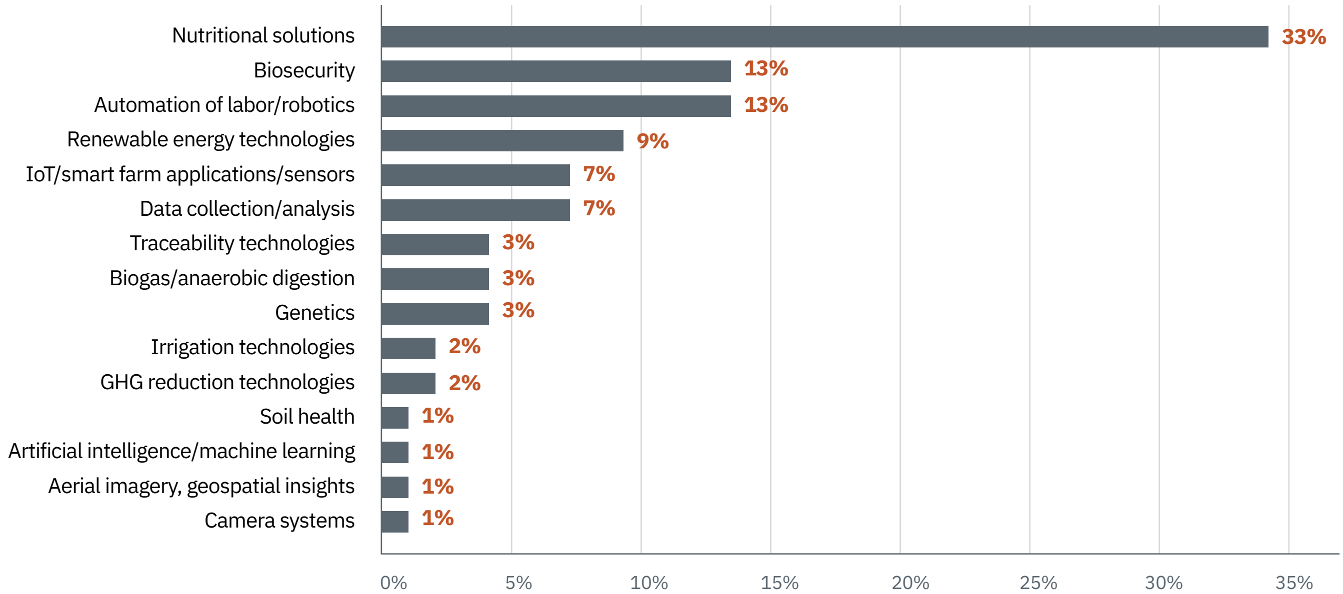
Dietary trends

Animal welfare

* *72% of Agri-Food Outlook respondents said product prices/ the economy is the consumer trend that is making the biggest impact on the agri-food industry*

Technologies making the biggest impact

Survey respondents said these technologies are providing exciting opportunities for growth



The role of technology

A variety of technologies are providing growth opportunities for the agri-food industry, survey respondents said. Among the technologies making the biggest impact are nutritional solutions, biosecurity and the automation of labor/robotics.

Of nutritional solutions, respondents noted enzymes (32%), technologies impacting rumen function (14%) and the management of mycotoxins (14%) as being the most significant to their market.

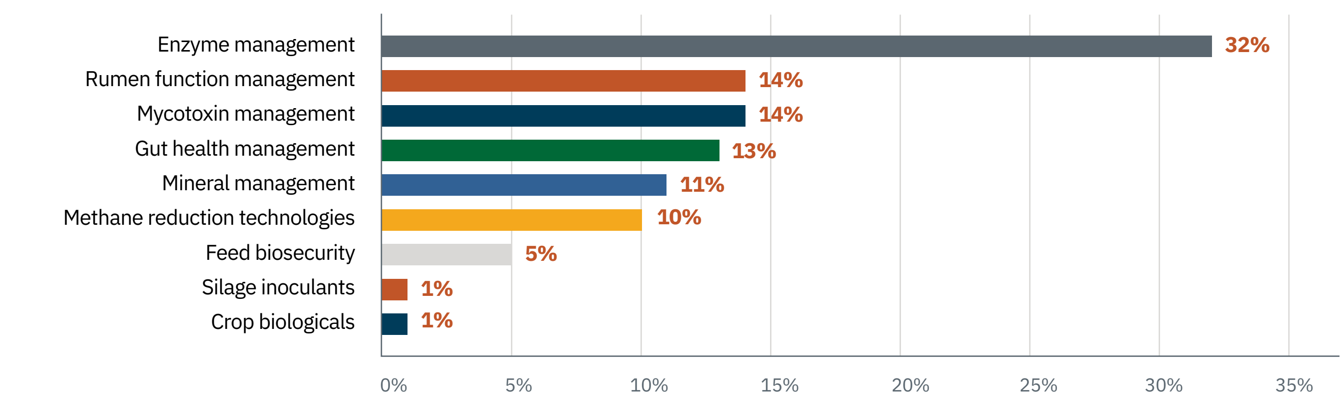
The use of enzymes to improve the digestibility of nutrients, decrease the cost of production and reduce the environmental impact of agriculture are having a significant positive impact, said one respondent from Spain.

Innovative technologies that increase efficiency and improve sustainability were cited by many participants as being highly promising and important.

“The biggest opportunities for growth are sustainable solutions for production costs, research and development for more durable and productive agricultural products [to mitigate] climate change, and new agricultural production technologies,” said a respondent from Turkey.

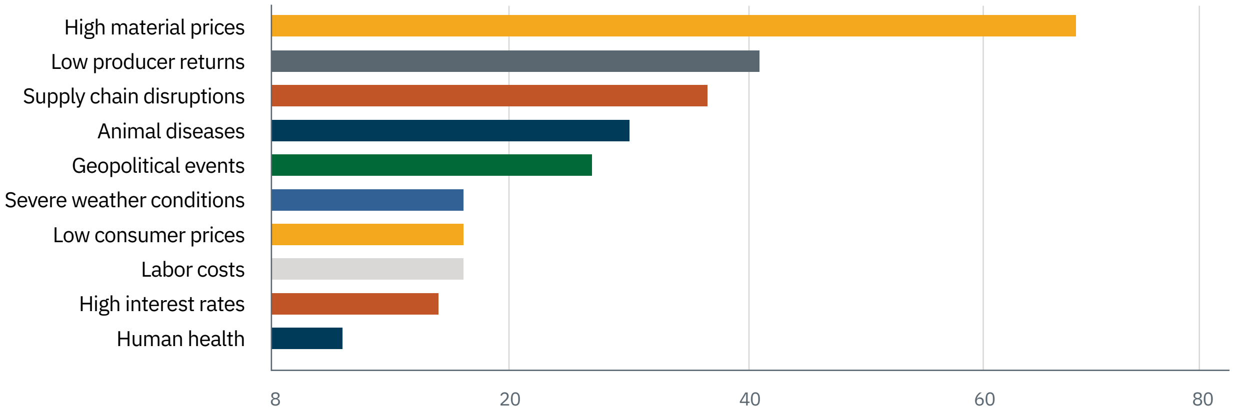
Top nutritional opportunities

Survey respondents said these nutritional solutions are most pertinent to feed production in their region



Top challenges to feed production*

Survey respondents identified the biggest ag-related challenges in their country



**Multiple choice question: Numbers indicate number of times the option was selected.*

Becoming more efficient with new-to-market technologies will improve profitability and help mitigate environmental impacts, a Canadian representative said.

Biggest challenges

Inflation and the overall state of the economy — particularly the increased prices of raw materials, feed and food — have been the biggest challenges affecting the agri-food sector in 2022, respondents said.

The state of the economy will remain one of the biggest factors influencing the success of the industry, said a participant from South Africa. Changes in consumer habits such as point of purchase and dietary trends are also making an impact.

"Due to the (COVID-19) epidemic, consumers' behavior has changed significantly and continuously, and they have taken a more proactive approach to health," said a survey respondent from China.

Supply chain disruptions remain an obstacle for the agri-food industry across all regions.

Many regions reported that geopolitical tensions — particularly the invasion of Ukraine — have affected imports and exports, the supply chain and raw materials prices.

"The war in Ukraine has had a significant impact on raw material supplies across the region," said a survey participant from Belgium.

The direct impact of the war was reported in Moldova and in Ukraine, where feed production fell by over 35%. The invasion of Ukraine also indirectly affected feed production throughout the rest of the world.

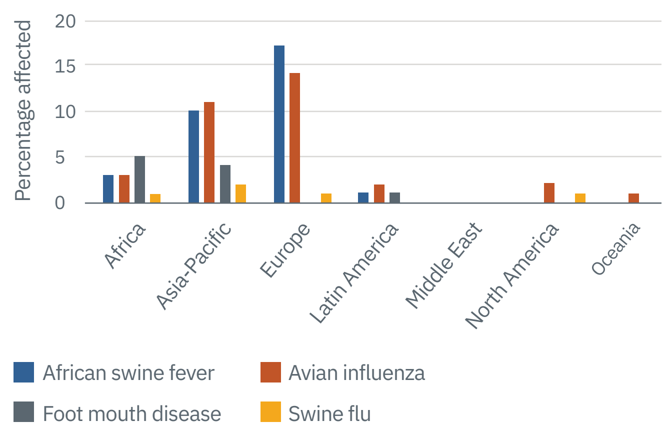
Disease disruptions

Animal diseases have disrupted feed production in more than 80% of countries.

Avian influenza affected all regions' feed production in 2022. In Africa, this disease manifested most significantly in Egypt, Morocco and South Africa. In Asia, nearly all countries were affected. In Europe, the affected countries included Belgium, Bosnia and Herzegovina, Bulgaria, France, Ireland, Moldova, the Netherlands, Poland, Russia, Serbia, Turkey, the U.K. and Ukraine.

In Europe, African swine fever (ASF) has most significantly affected Ireland and countries in the East. In the Americas, the Dominican Republic was affected most significantly. In

Diseases that impacted feed demand in 2022



Asia, ASF has played a significant role in China, Indonesia, Malaysia, Myanmar, Nepal, the Philippines, Singapore, South Korea, Thailand and Vietnam. In Africa, Kenya, Mozambique and Namibia were affected.

Foot and mouth disease (FMD) was an issue in Africa, particularly in Egypt, Mozambique, Namibia and South Africa. In Asia, Indonesia, Mongolia, South Korea and Thailand were affected. Finally, in the Americas, FMD was an issue in Bolivia.

Swine flu was an issue in Namibia, China, Myanmar, Belgium and the U.S.

Overall, Latin America and the Middle East did not report many instances of disruption due to animal diseases.

Sustainability insights

Efforts to improve environmental sustainability are impacting the feed/animal agriculture sector in most regions, survey respondents said. The majority of respondents said sustainability efforts are being driven by the government (50% of respondents), food producers and processors (47.27%), consumers (44.74%) and retailers/ food service companies (39.47%).

The top sustainability measures being implemented include reducing antibiotic usage and antimicrobial resistance (AMR), improving animal welfare, producing food more efficiently, reducing water pollution, creating renewable energy, reducing greenhouse gas emissions, and enhancing nutritional value and food security.

Survey respondents said that some of the biggest ag-related opportunities are new technologies like smart-farm applications, increasing efficiency, incorporating more nutritional solutions and continuing to make efforts to become more sustainable.

New Alltech survey gathers industry insights

Alltech believes a sustainable agri-food sector is both possible and essential, and that our industry is uniquely positioned to positively shape the future of our planet. We are committed to uniting the agri-food community in Working Together for a Planet of Plenty™, a planet that can provide nutrition for all, revitalize local economies and replenish the planet's natural resources.

As part of our commitment, we have been consulting with key stakeholders and thought leaders from across the value chain. From farmers and feed mills to business leaders and retailers, academics, commentators and NGOs from around the world, we are listening to the voices of our industry to help us refine our strategy and prepare for the challenges that lie ahead. By sharing our learnings, we hope to provide insight, direction and momentum to the actions required.

Our industrywide consultation thus far has solicited comments from over 25 global experts. In February, we will launch our full insights survey, which will allow us to explore how the agri-food industry can improve and optimize the global food system, affecting real change across the value chain.

We invite you to participate in the Alltech Global Insights Survey. Stay tuned to alltech.com for news about how to participate in the survey.

AGRI-FOOD OBSERVATIONS

Animal diseases have disrupted feed production in more than **80%** of reporting countries.

Feed tonnage by region

Based on data collected in November 2022, Alltech estimates that the total global feed tonnage in 2022 decreased slightly — by 5.381 million metric tons (MT), or 0.42% — to approximately 1.266 billion MT.

The survey showed a 3.86% decrease in feed tonnage in Africa, mainly because of reductions reported in Egypt, Morocco, Kenya and Nigeria. South Africa, on the other hand, saw an increase of more than 2%, and Namibia also reported higher feed tonnage in 2022.

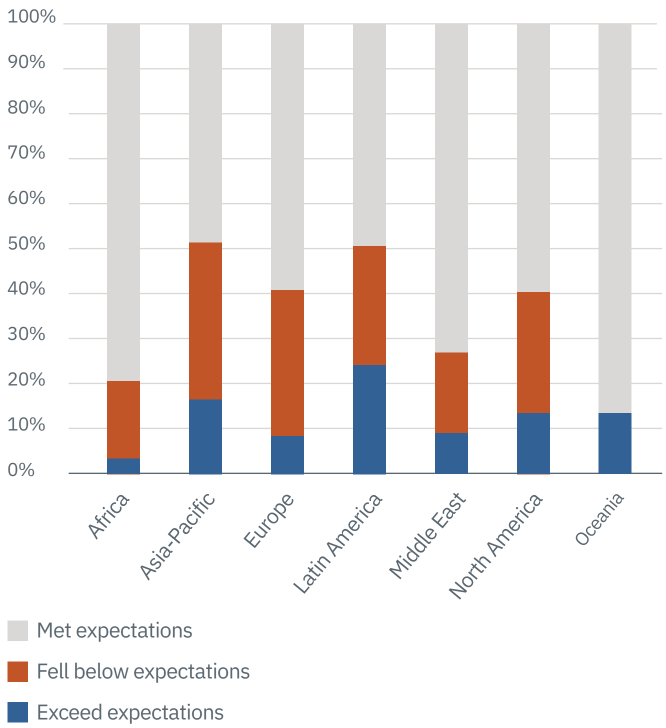
The Asia-Pacific region was flat. Reductions in China, Pakistan, Thailand and Malaysia were offset by increases reported by Vietnam, the Philippines, Mongolia and South Korea. Despite the challenges faced there, Vietnam has been a growth market for feed in Asia.

The biggest retreat in feed tonnage was seen in Europe, where it was down nearly 5%, or over 12 million metric tons (MMT). Some of the primary factors for this decreased production include the invasion in Ukraine and the spread of animal diseases, such as ASF and avian influenza.

Among the big four regions, Latin America came out on top this year as the winner in terms of growth in feed tonnage, with an increase of over 3 MMT. Most of this growth was reported by Mexico, Brazil and Chile.

2022 expectations

59% of Alltech Agri-Food Outlook respondents said feed production in their region met their expectations



Region	Sum of 2021 total feed production (MMT*)	Sum of 2022 total feed production (MMT)	Growth (MMT)	Growth (%)
Africa	44.506	42.788	-1.718	-3.86%
Asia-Pacific	467.922	465.540	-2.382	-0.51%
Europe	276.114	263.232	-12.882	-4.67%
Latin America	187.904	190.910	3.006	1.6%
Middle East	25.484	31.785	6.301	24.73%
North America	259.367	261.639	2.272	0.88%
Oceania	10.433	10.466	0.033	0.32%
Grand Total	**1,271.731**	**1,266.350**	**(5.381)**	**-0.42%**

**Million metric tons*
***Latin America includes all Central American countries, including Mexico*
****North America includes Canada and the U.S.*

The Middle East region is also up significantly, as a result of more accurate reporting and efforts by the Saudi Arabian government to increase broiler production as part of its Vision 2030 plan.

North America (the U.S. and Canada) reported an increase of more than 2.4 MMT (all in the U.S.). Growth was reported in the broiler, beef and pet food sectors.

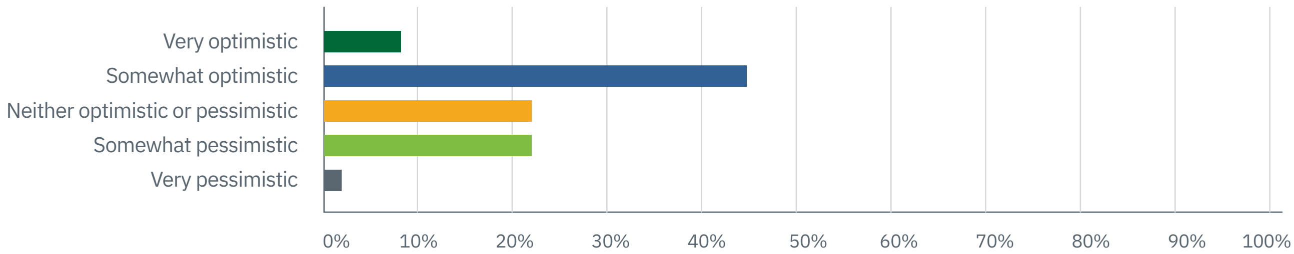
The region of Oceania was flat, with a small reduction reported by Australia that was offset by a slight increase reported by New Zealand.

The majority of respondents, 59%, said that feed production in their country met their expectations in 2022. Feed tonnage fell below expectations for 28% of survey respondents and exceeded expectations for 13%.

Looking ahead, over half of respondents (52.5%) said they are optimistic that feed production in their country will grow in 2023.

Outlook for 2023

Over half of respondents said they are optimistic that feed production will grow in 2023



Top 10 countries

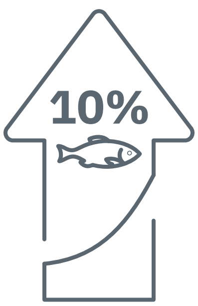
Together, the top 10 countries consume 64% of the world's feed, and half of the world's global feed consumption is concentrated in four countries: China, the U.S., Brazil and India.

Vietnam experienced a great recovery in terms of its feed tonnage in 2022, entering the top 10 ahead of Argentina and Germany and crowding out Turkey, which reported reduced feed tonnage. Russia overtook Spain, where there was a significant reduction in feed production.

Country	Sum of 2021 total feed production (MMT*)	Sum of 2022 total feed production (MMT)	Growth (MMT)	Growth %
China	268.343	260.739	(7.604)	-2.83%
United States	237.977	240.403	2.426	1.02%
Brazil	81.239	81.948	0.709	0.87%
India	44.059	43.360	(0.700)	-1.59%
Mexico	39.684	40.138	0.454	1.14%
Russia	33.000	34.147	1.147	3.48%
Spain	35.838	31.234	(4.604)	-12.85%
Vietnam	20.920	26.720	5.800	27.72%
Argentina	26.719	25.736	(0.983)	-3.68%
Germany	24.506	24.396	(0.110)	-0.45%

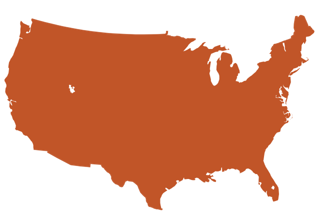
A closer look at the top 3 countries

China



- Overall feed production dropped by nearly 3%
- Pig feed dropped by 5%
- Broiler feed production was down 3%
- Layer feed production decreased by 3%
- **On the upside:** China reported a 10% (2 MMT) increase in feed tonnage for aquaculture
- **Tech:** Artificial intelligence/machine learning is making the biggest impact on agriculture, according to the survey
- **Consumer trends:** Changes in eating habits for environmental and health reasons are the biggest consumer trend affecting agriculture in China, the survey found
- **Challenges:** High ingredient prices, low producer returns, supply chain disruptions, animal diseases, geopolitical events
- **Outlook:** Somewhat pessimistic that feed production will grow in 2023

United States



- Overall production was up 1.02%
- Pet feed grew by 6.12%
- Broiler feed production rose by 3.5%
- Layer feed increased 3%
- Aquaculture feed was up 2.15%
- Beef feed grew by nearly 1%, and equine was up 0.67%
- **Tech:** Biosecurity measures are making the biggest impact on agriculture
- **Consumer trends:** Product prices/the economy are the number-one consumer trend affecting the industry
- **Challenges:** High material prices, low producer returns, supply chain disruptions
- **Outlook:** Somewhat optimistic that feed production will grow in 2023

Brazil

- Overall feed production was up 0.87%
- Dairy feed tonnage was down 3%
- Beef feed tonnage was up 3%
- Layer tonnage decreased 4%
- Broiler feed tonnage increased 1%
- **Tech:** Data collection and analysis is the technology making the most impact on agriculture.
- **Consumer trends:** Product prices/economy was the biggest consumer trend affecting the industry.
- **Challenges:** Supply chain disruptions, severe weather conditions, geopolitical events
- **Outlook:** Somewhat optimistic that feed production will grow in 2023.

Feed production estimates by sector

Globally, feed tonnage increased in the broiler, layer, aquaculture and pet food sectors. Volume growth in feed tonnage came predominantly from the broiler feed sector.

Percentage wise, the biggest growth was in pet food. The pig, dairy and beef sector experienced decreased feed tonnage.

Sector	2021 feed tonnage (MMT*)	2022 feed tonnage (MMT)	Growth (MMT)	Growth %
Broiler	359.387	363.960	4.573	1.27%
Pig	329.185	319.383	(9.802)	-2.98%
Layer	161.356	161.849	0.493	0.31%
Dairy	135.616	133.823	(1.793)	-1.32%
Beef	118.441	118.042	(0.399)	-0.34%
Aqua	51.510	52.914	1.403	2.72%
Pets	32.884	35.270	2.430	7.25%
Equine	8.091	8.159	0.068	0.83%
Grand Totals*	**1,271.731**	**1,266.350**	**(5.381)**	**-0.42%**

**Million metric tons*
***Grand total includes listed species as well as calf, other ruminants, turkeys, other poultry and other species.*

Feed mills

As consolidation continues, the number of feed mills continues to decrease and output by large feed mills continues to rise. The number of total feed mills in 2022 was down slightly, about one half of one percent, from 2021.

The biggest reductions in feed mill numbers were seen in Europe, specifically in Spain, Poland, Ukraine, Russia and Hungary. Feed mill numbers in some African countries (Ghana, Mozambique and Namibia) were previously underreported, when only the largest feed mills were included in the survey.

Country	Count of mills, 2021	Count of mills, 2022	Growth	Growth %
Africa	2,309	2,357	48	2.08%
Asia-Pacific	6,989	7,146	157	2.25%
Europe	6,970	6,553	(417)	-5.98%
Latin America	4,765	4,806	41	0.86%
Middle East	795	799	4	0.50%
North America	6,280	6,300	20	0.32%
Oceania	194	195	1	0.52%
Grand Total	**28,302**	**28,156**	**(146)**	**-0.52%**

Broilers

While the overall tonnage in the broiler sector increased by about 1.3%, there were significant differences from country to country. Overall, feed production growth in the broiler sector was reported mainly from the Middle East, North America and Latin America.

Global poultry markets are expected to stay strong in 2023 but may have some price and volume swings depending on the region.

A closer look

Africa: There were increases in broiler feed tonnage in some countries, but those were offset by a big reduction in Kenya, where feed production dropped over 44%.

Asia-Pacific: Broiler feed production decreased in China but increased in Vietnam. In China, production was affected by low market demands and high raw materials prices. In India, higher broiler feed prices continue to challenge the industry's margins and limit capacity growth. Avian influenza affected India, Japan, Korea and Vietnam. Feed production in the Philippines increased significantly, due to a switch from pig farming to broilers because of African swine fever (ASF).

Europe: Poultry production in Europe was significantly affected by avian influenza and the high price of raw materials and energy.

Latin America: Brazil and Mexico, which represent most of the market for broilers in Latin America, had steady numbers from 2021 to 2022.

Middle East: In Saudi Arabia, local broiler production is expanding to lower the country's dependence on chick imports.

North America: Broiler feed production was up over 3% and broiler exports were flat. Broiler production is growing slowly each year and will most likely continue at this pace.

Oceania: Feed production was up over 2%.

AGRI-FOOD OBSERVATIONS

The broiler sector had the **highest global feed production**, with nearly 364 million metric tons.

Region	2021 broiler feed tonnage (MMT*)	2022 broiler feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	13.956	13.126	(0.830)	-5.95%
Asia-Pacific	153.404	153.532	0.128	0.08%
Europe	54.938	54.169	(0.769)	-1.40%
Latin America	66.717	67.561	0.845	1.27%
Middle East	8.217	11.401	3.184	38.75%
North America	58.200	60.132	1.932	3.32%
Oceania	3.956	4.039	0.083	2.10%
Grand Total	**359.387**	**363.960**	**4.573**	**1.27%**

**Million metric tons*

Pigs

Globally, feed production was down in 2022 by almost 3%. African swine fever (ASF) and high feed prices depressed pig production in many countries. However, in Vietnam, China, South Africa, Brazil and Mexico, better pork prices and other market conditions led to growth in the sector.

A closer look

Africa: Production was down slightly, due in part to ASF and high feed costs. Better pork prices in South Africa led to an increase of 0.175 MMT of pig feed production.

Asia-Pacific: Vietnam feed production increased by 3.36 MMT in 2022. Production has recovered to nearly the same level it was before the region was challenged by ASF. As pork prices increase, more farms are investing in pigs.

Low pork prices led to a decrease of 5.5 MMT in pig feed production in China. Because of a sharp increase in the number of breeding sows in 2021, pigs sold quickly in the first half of 2022, lowering the price of pork and leading to a decline in the number of live pigs. In the first eight months of 2022, consumption of pig feed decreased by about 8%, according to the China Feed Industry Association.

Thailand's pig feed production was reduced by 1.01 MMT because of ASF.

Europe: ASF affected the Eastern European countries and Ireland, where feed tonnage was down 2.16%. Germany reported an 8% reduction in feed tonnage due to a ban on exports to Asia. High production costs and low pork prices affected pig producers, but prices are showing signs of recovery.

Latin America: The pig industry expanded in Latin America, thanks to increased demand, decreases in the cost of food, favorable exchange rates and numerable opportunities to export to Asia. Brazil's feed tonnage grew by 4%, from 19.7 MMT to 20.5 MMT.

Middle East: Production remained steady in Israel, the only Middle Eastern country that produces pig feed.

North America: Feed production decreased by nearly 1% because of a reduction in pork supply, aggressive outbreaks of porcine reproductive and respiratory syndrome (PRRS), high feed and trucking costs, disruptions in trade due to shipping costs, labor shortages and input cost volatility aggravated by the invasion of Ukraine.

Oceania: Pig feed production remained steady in Australia and increased over 8% in New Zealand to 0.164 MMT.

Region	Sum of 2021 pig feed tonnage (MMT*)	Sum of 2022 pig feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	3.319	3.317	(0.002)	-0.05%
Asia-Pacific	143.537	140.377	(3.159)	-2.20%
Europe	81.871	75.117	(6.754)	-8.25%
Latin America	35.450	36.167	0.717	2.02%
Middle East	0.007	0.007	0.000	0.50%
North America	63.600	62.984	(0.616)	-0.97%
Oceania	1.401	1.414	0.013	0.93%
Grand Total	**322.266**	**319.383**	**(9.802)**	**-2.98%**

**Million metric tons*

Layers

Avian influenza, other diseases and the high costs of raw materials affected the layer sector in many markets, especially in Asia, Europe and Africa. On the other hand, growth in the sector was boosted due to bigger challenges in other sectors that led to increased demand for eggs. Overall, layer-sector feed production increased by just one-third of 1%.

In areas hit by avian influenza, the availability of breeding stock has been tight, restricting production growth and expansion. Disease, macroeconomic headwinds and long periods of high input costs are limiting poultry growth worldwide.

A closer look

Africa: Kenya reported a 42.5% (0.3 MMT) reduction in layer feed tonnage because of high production costs. Over 40 layer producers have closed their operations there in recent months.

Asia-Pacific: Although the 2022 price for eggs was relatively high in China, the feed material cost (maize and soybean meal) was prohibitive to layer production. The number of laying hens in stock in 2022 decreased significantly compared with 2021. Layer feed tonnage was down 3%, or a reduction of 1 MMT. In the Philippines, layer feed production increased by 0.734 MMT — or 28% — because ASF prompted conversions from swine production to layer and broiler farms. India reported an 8% decrease in layer feed tonnage because many small layer farms shut down.

Europe: Europe witnessed a tight poultry market with a strong price. Poultry production is expected to drop, keeping prices high, because of ongoing avian influenza pressure and high input cost. For UK poultry, declining self-sufficiency is expected to continue in 2023, with a slight increase in imports from the Netherlands, Poland and Thailand.

Latin America: Feed value increased because countries such as Argentina increased egg production. In Brazil, the rise of the raw materials prices and the slow increase of final prices put the egg industry in a difficult situation. Demand was slower and prices were higher. In 2021, there was a decrease in the number of breeders, which continued to affect the industry in 2022, but a recovery is expected by the end of 2023.

Middle East: Feed production increased nearly 8%.

North America: Layers were more affected by avian influenza than any other poultry species in the U.S in 2022. More than 57 million commercial birds in the U.S. were affected, mostly layers and turkeys.

Oceania: Layer feed production climbed nearly 3%, with nearly every country increasing in feed tonnage.

Region	2021 layer feed tonnage (MMT*)	2022 layer feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	9.545	9.224	(0.321)	-3.36%
Asia-Pacific	76.481	75.940	(0.541)	-0.71%
Europe	30.988	30.672	(0.316)	-1.02%
Latin America	23.629	24.506	0.877	3.71%
Middle East	4.621	4.977	0.356	7.70%
North America	15.120	15.530	0.410	2.71%
Oceania	0.972	1.001	0.029	2.98%
Grand Total	**161.356**	**161.849**	**0.493**	**0.31%**

**Million metric tons*

Dairy

In most countries, there was a decline in commercial feed production for dairy, mainly due to the high cost of feed combined with low milk prices, which caused farmers to reduce their numbers of cows and/or rely more on non-commercial feed sources. Some exceptions included Ireland, where drought caused farmers to rely more on commercial feeds, and New Zealand, where milk prices were higher. In total, we saw about 1.32% less compound feed produced in the global dairy sector.

A closer look

Africa: Dairy feed tonnage dropped or remained flat in most of the feed-producing countries.

Asia-Pacific: Vietnam reported a 16% growth in feed production. Smaller increases were reported in India, China, Japan, Thailand, Malaysia, Taiwan and Mongolia. Nepal, Pakistan, Sri Lanka and and Bangladesh reported decreases in dairy feed tonnage because of reduced milk consumption and reductions in breeder stock.

Europe: Many countries saw reductions in dairy feed tonnage, including the Netherlands, Kazakhstan, Turkey, Spain, Poland, Sweden, Belgium, Ukraine and Bulgaria, among others. There was a 6% increase in feed production in Ireland, where summer droughts necessitated the need for supplementary feed. Increases also were reported in Portugal, the Czech Republic, Austria, Lithuania, Hungary and others.

Latin America: Peru reported a double-digit feed production decrease in 2022 due to a reduced commercial dairy population in the region. Brazil's dairy feed production dropped in 2022 because of unfavorable weather that resulted in poorer pasture conditions, as well as lower consumer demand, economic challenges, low consumer disposable income and elevated milk retail prices.

Middle East: Dairy feed production increased in nearly every country.

North America: Feed tonnage dropped slightly in 2022, with the U.S. and Canada reporting a 0.82% and 0.70% decline in dairy feed production, respectively. A reduction in dairy cows slowed feed production in the U.S., where high building costs and feed costs have limited expansion.

Oceania: There was a 23.7% (0.028 MMT) increase in New Zealand's dairy feed tonnage. High milk prices encouraged farmers to feed more, but that was tempered by high feed prices. Australia's dairy feed production was down over 7%, leading to an overall regional decline of nearly 5%.

Region	Sum of 2021 dairy feed tonnage (MMT*)	Sum of 2022 dairy feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	5.580	5.071	(0.509)	-9.12%
Asia-Pacific	24.136	24.154	0.018	0.07%
Europe	43.416	42.199	(1.217)	-2.80%
Latin America	25.738	25.461	(0.277)	-1.08%
Middle East	6.528	6.992	0.464	7.11%
North America	28.700	28.500	(0.200)	-0.70%
Oceania	1.518	1.446	(0.072)	-4.74%
Grand Total	**135.616**	**133.823**	**(1.793)**	**-1.32%**

Million metric tons

Beef

The trend toward a reduction in beef feed production appears to have slowed, with feed production down only 0.34% in 2022. The downward trend continued in Europe, but increases were seen in almost all other regions. In Australia, the reduction in feed tonnage was a result of plentiful grass and not a reflection of any changes in the demand for beef.

Growth in 2023 is expected in China, Brazil and Australia, while decreases are anticipated in the U.S., Canada and in countries throughout Europe.

A closer look

Africa: Beef feed production grew nearly 4% in 2022, with the biggest increases happening in Namibia and Mozambique.

Asia-Pacific: Feed millers in Bangladesh are focusing more on cattle feed, as the market for concentrate feed is growing significantly. As a result, that country reported a 56% increase in its beef feed production, from 0.261 MMT to 0.408 MMT. South Korea reported a 3% increase in feed production, from 4.06 MMT to nearly 4.2 MMT. China and Japan also reported small increases.

Europe: Though several countries reported significant increases, overall feed production was down over 10%. Bulgaria reported a small shift from dairy to beef production because of low milk prices. In many cases, drought and higher beef prices incentivized feed supplementation.

Latin America: The high prices of bovine animals and meat in 2022 provided a steady incentive for cattle growers to expand production.

Middle East: There was very little growth in beef feed production in 2022.

North America: The region is in its fourth straight year of declining herd population caused by drought and economic issues, but it has not affected feed production. Experts anticipate 2023 to be the tipping point, with a predicted decline of 2-3%. Additional economic pressure will be put on the American producer; the American dollar is expected to remain strong and exports are likely to decrease.

Oceania: Production dropped in both Australia and New Zealand. The region reported a 12% decline in beef feed tonnage.

Region	Sum of 2021 beef feed tonnage (MMT*)	Sum of 2022 beef feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	2.479	2.575	0.095	3.84%
Asia-Pacific	13.810	14.279	0.469	3.40%
Europe	17.542	15.765	(1.776)	-10.13%
Latin America	15.642	16.015	0.373	2.39%
Middle East	1.456	1.556	0.100	6.89%
North America	66.772	67.355	0.429	0.64%
Oceania	0.740	0.650	(0.090)	-12.16%
Grand Total	**118.441**	**118.042**	**(0.399)**	**-0.34%**

**Million metric tons*

Aquaculture

The aquaculture sector experienced a total global feed production growth of 2.7%. The top 5 aquaculture feed countries are China, Vietnam, India, Norway and Indonesia. Significant increases were reported in China, Brazil, Ecuador, the Philippines and the U.S. The aquaculture sector was one of a few sectors up in Europe, where large decreases in feed production were reported.

A closer look

Africa: Aquaculture feed production was down 2.38% in 2022, though increases were reported in South Africa, Zimbabwe, Zambia, Ghana and Seychelles.

Asia-Pacific: With the recovery of China's economy and improvements in living standards in recent years, the demand for aquatic products has been increasing. The scale of the region's aquaculture industry expanded in 2022. There also was feed production growth in the Philippines, Bangladesh, South Korea, Malaysia and others.

Europe: Aquaculture feed tonnage grew by 1.78%

Latin America: Ecuador has become the No. 1 shrimp producer in the world, and 2022 was a record year for feed production. It had a 17% increase in feed tonnage.

Middle East: Slight growth was reported in the Middle East, where all countries had feed tonnage increases or stayed at the same level as 2021.

North America: Aquaculture feed tonnage was up 2% (0.02 MMT) due to increases in fish prices, favorable weather conditions and the lifting of size restrictions.

Oceania: Australia's feed tonnage was up over 5% in 2022.

AGRI-FOOD OBSERVATIONS

Survey respondents said the **top 3 technologies** making the most impact on agri-food are:

- Nutritional solutions, 33%
- Biosecurity, 13%
- Automation of labor/robots, 13%

Region	Sum of 2021 aqua feed tonnage (MMT*)	Sum of 2022 aqua feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	1.484	1.449	(0.035)	-2.38%
Asia-Pacific	37.350	38.340	0.990	2.65%
Europe	4.605	4.687	0.082	1.78%
Latin America	5.652	5.922	0.271	4.79%
Middle East	0.500	0.566	0.066	13.14%
North America	1.730	1.750	0.020	1.16%
Oceania	0.190	0.200	0.010	5.26%
Grand Total	**51.510**	**52.914**	**1.403**	**2.72%**

**Million metric tons*

Pets

Of all of the species sectors measured in the Agri-Food Outlook survey, the pet food sector — which increased by 7.25% — had the most significant growth. It was up even in Europe, the region that dipped most in 2022 feed production.

Region	Sum of 2021 pet feed tonnage (MMT*)	Sum of 2022 pet feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	0.454	0.342	(0.111)	-24.57%
Asia-Pacific	2.267	2.478	0.212	9.33%
Europe	11.587	11.778	0.191	1.65%
Latin America	7.434	8.863	1.429	19.22%
Middle East	0.090	0.106	0.016	17.25%
North America	10.600	11.200	0.600	5.66%
Oceania	0.452	0.502	0.050	11.06%
Grand Total	**32.884**	**35.27**	**2.386**	**7.25%**

**Million metric tons*

Equine

The equine sector increased by 0.83%, growing in all regions except Latin America. It displayed the highest growth in Asia-Pacific and Oceania.

Region	Sum of 2021 equine feed tonnage (MMT*)	Sum of 2022 equine feed tonnage (MMT)	Growth (MMT)	Growth %
Africa	0.078	0.079	0.001	1.25%
Asia-Pacific	0.494	0.536	0.042	8.51%
Europe	2.129	2.152	0.023	1.09%
Latin America	1.093	1.043	(0.050)	-4.54%
Middle East	0.137	0.139	0.002	1.47%
North America	3.778	3.800	0.022	0.58%
Oceania	0.383	0.410	0.027	7.05%
Grand Total	**8.091**	**8.159**	**0.068**	**0.83%**

**Million metric tons*