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Zacks Small-Cap Research

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Marrone Bio Innovations, Inc. (MBII-NASDAQ)

MBII: Initiating coverage on the only public pure-play in the biopesticide market.

Biopesticides are the highest growth segment in the agricultural business. Existing products and new technologies awaiting approval are expected to drive earnings into profitable territory within four years.

OUTLOOK

Marrone Bio Innovations is the only pure play in the growing biopesticide arena. The company has a large patent portfolio that should generate new products and product extensions over at least the next five years. The R&D is focused on the largest market segments. The existing market of chemical pesticides is expected to give way to more ecologically sound biopesticides especially within the fruit and vegetables segment for both organic and conventional growers.

Current Price (04/03/19)	$1.42
Valuation	**$2.00**

SUMMARY DATA

52-Week High	**$3.25**
52-Week Low	**$1.17**
One-Year Return (%)	**-44.1**
Beta	**-0.2**
Average Daily Volume (sh)	**121,307**
Shares Outstanding (mil)	**110.7**
Market Capitalization ($mil)	**$156**
Short Interest Ratio (days)	**N/A**
Institutional Ownership (%)	**80**
Insider Ownership (%)	**1**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**11.0**
Earnings Per Share (%)	**N/M**
Dividend (%)	**N/M**
P/E using TTM EPS	**N/M**
P/S using 2019 Estimate	**5.5**
P/S using 2020 Estimate	**4.4**

Risk Level	**Above Avg.,**
Type of Stock	**Small-Growth**
Industry	**Chem-Diversifd**
Zacks Rank in Industry	**N/A**

ZACKS ESTIMATES

Revenue
(in millions of $)

	Q1 (Mar)	Q2 (Jun)	Q3 (Sep)	Q4 (Dec)	Year (Dec)
2017	**$4.15A**	**$6.48A**	**$4.22A**	**$3.32A**	**$18.17A**
2018	**$4.32A**	**$5.75A**	**$5.43A**	**$5.72A**	**$21.22A**
2019	**$6.10E**	**$7.60E**	**$7.10E**	**$7.30E**	**$28.10E**
2020	**$7.60E**	**$9.60E**	**$9.13E**	**$9.30E**	**$35.63E**

	Q1 (Mar)	Q2 (Jun)	Q3 (Sep)	Q4 (Dec)	Year (Dec)
2017	**-$0.31A**	**-$0.25A**	**-$0.27A**	**-$0.24A**	**-$1.06A**
2018	**-$0.04A**	**-$0.04A**	**-$0.04A**	**-$0.07A**	**-$0.20A**
2019	**-$0.05E**	**-$0.04E**	**-$0.04E**	**-$0.05E**	**-$0.18E**
2020	**-$0.04E**	**-$0.03E**	**-$0.03E**	**-$0.04E**	**-$0.14E**

Zacks Projected EPS Growth Rate - Next 6 Years % **40**

Annual EPS is impacted by changes in share count.

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RECENT NEWS

Zacks Small Cap. Research has initiated coverage on Marrone Bio Innovations with a $2.00 price target.

Fourth quarter revenue was ahead of projections due to better than expected sales of Venerate.

In Dec. 2018 Marrone launched TerraConnect, a new biological soil applied and seed treatment platform delivering high performance products with a broad range of tools to improve and protect crops. TerraConnect is a tailored solution that unites biology and chemistry to protect plants and improve yields.

Expanded international distribution network. Added Vietnam, Cambodia, Turkey, South Korea.

KEY POINTS

Founded by Dr. Pamela Marrone Ph.D. in 2006 Marrone Bio Innovations is the only pure play in the biopesticide arena. All the others are either subsidiaries of large agricultural companies or are small and privately owned. Dr. Marrone was the founder of AgraQuest Inc. (acquired by Bayer) and a founding president of Entotech, Inc.

It is estimated that the potential loss of worldwide crop production without the use of pesticides could be as much as 37% in dollar terms. The use of pesticides reduces the loss to about 14%. Pesticides are essential on a worldwide basis.

Bio pesticides are derived from naturally occurring substances, compounds and microorganisms and are not based on synthetic chemicals.

The company is focused primarily in the bio-fungicide, bio-insecticide and plant stimulant markets, plus a new entrant in molluscicide treatment. It is not involved in the fertilizer segment. All products are competitive in price and efficacy.

Trends are towards increased cultivation of organic qualified crops. All of MBII's current products are certified for organic food production.

The phase-out of current chemical pesticides due to health concerns and potential damage to the environment opens the door to new, more selective, biopesticides. The company's products are environmentally friendly.

Many chemical pesticides cause pest resistance which does not occur with biopesticides.

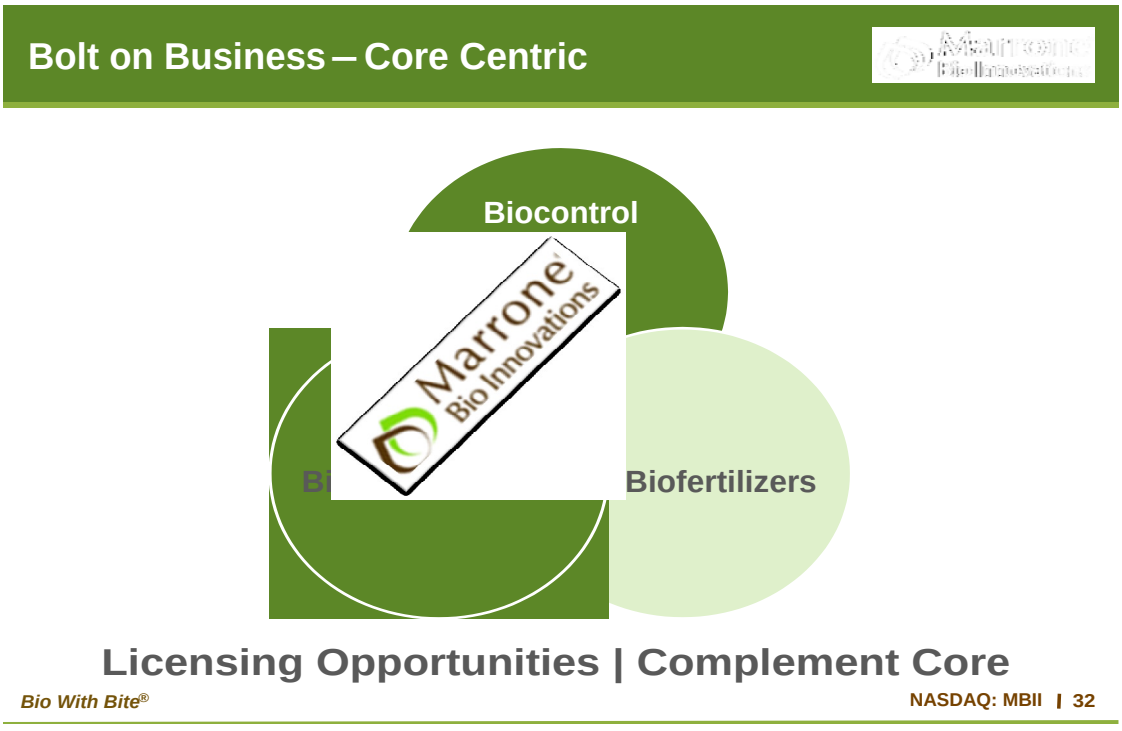
The company has a strong, and patent protected, series of products that have been introduced over the last ten years, with most of them being relatively new. This slate of products is now in the third stage of market introduction and is expected to add to the already impressive revenue growth. There is also a series of new products that will be introduced over the next few years.

Marrone has 35 U.S. and 199 foreign patents with 31 U.S. and 146 foreign patents pending. These cover the proprietary microorganisms, the compounds produced by these organisms, novel mixtures of compounds and the use of these compounds and mixtures in treating pests.

Marrone Bio Innovations has Vertically Integrating Manufacturing facilities in Bangor MI [just north of I94 and east of Lake Michigan]. It has three 20,000L fermentation tanks for a total of 15,582 US gallons, mixing tanks, centrifuges that are currently used for the production of Regalia, Grandevo and Zequanox. The facility is scalable and Majestene and Venerate capacity will be added as needed. Contracted capacity adds 50,000L as needed.

BIO-UNITE strategy The combination of the power of biology and the performance of chemistry.

It has been shown that the combination of biological products and chemical pesticides are more effective than either treatment alone.



For example adding Regalia Rx to the current fungicide treatments on corn significantly increases the yield. Traditional insecticide treatments for navel orangeworms on almonds was much improved when Venerate XC was included in the current commercial standard treatment.

According to Dan Custis, CEO of Advanced Biological Marketing (ABM) on March 1, 2019:

In the row crop world, the majority of biopesticide deployments are going out alongside, not in place of, traditional crop protection chemistries.

Year	**Product**	**Function**	**Major pests**	**Major use/market**	Inter-
					national
2008	**Regalia**	**Fungicide**	powdery mildew	Almonds, Grapes, Cannabis	world wide
2011	**Grandevo**	**Insecticide**	mites, thrips	Fruit, vegatables, Canabis	Mexico
2016	**Venerate**	**Insecticide**	mites, thrips aphids	Fruit, nuts, cannabis	Mexico
2016	**Majestene**	**Nematicide**	Plant parasitc nematodes	Corn,soybeans, cotton	in progress
2018	**Zelto**	**Nematicide**	parasitic nematodes	Turf, golf courses	N
2017	**Haven**	**Stimulant**	excess sunlight & heat stress	Almonds, citrus	Canada
2017	**Stargus**	**Fungicide**	downy mildew, white mold	Grapes, apples. Strawberries	Canada
2017	**Amplitude**	**Fungicide**	white mold , soil diseases	Beans, dried beans (pulse crops)	Canada
2018	**Zequanox**	**Molluscide**	zebra & quagga mussels	Power plants, industrial plants.	Canada
Near-term introductions:					
	Ennoble	**fumigant**	Soil diseases & nematodes	Strawbwrries, tomatoes potatoes	
	MBI-014	**herbicide**	broad range of weeds	Pigweed in cotton, soybeans	
	Combination products		Next generation multifunctional mixtures.		

Strong Product Portfolio

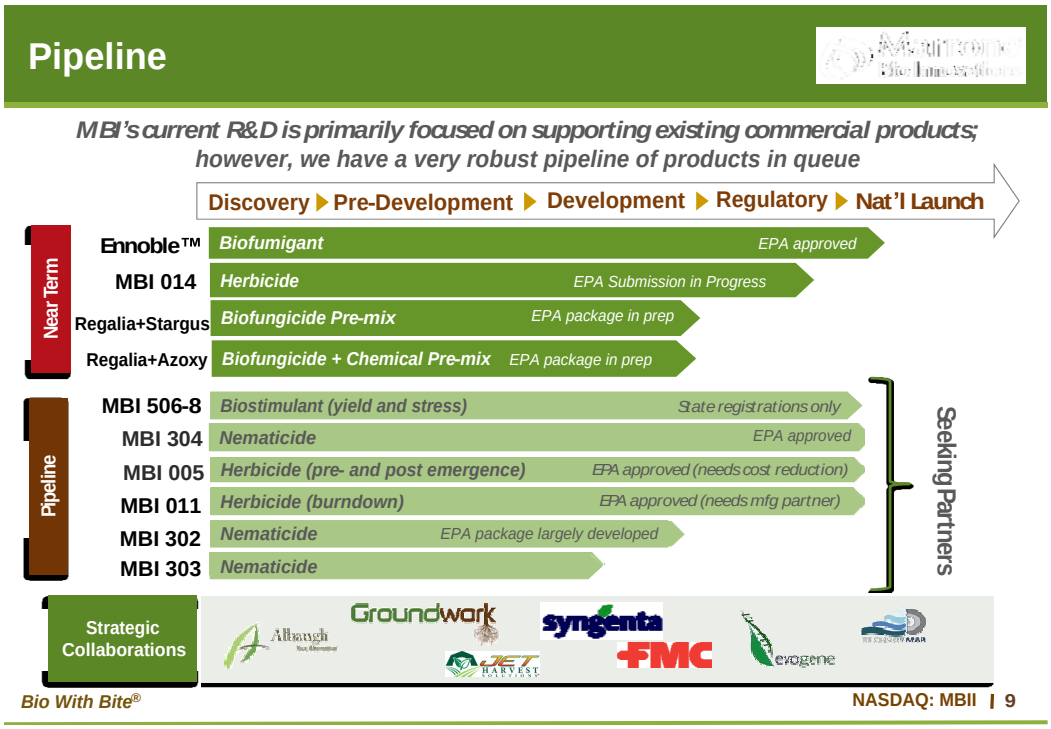
Finding Solutions for Pests, Diseases and Crop Stress

Product	What is it?	Category	What Does it Do?
REGALIA	Knotweed extract	Fungicide Plant health	• Controls **plant diseases** and improves plant health • Strong on **powdery mildew**
STARGUS AMPLITUDE	New strain of *Bacillus* bacteria	Fungicide Plant health	• Controls **plant diseases** and improves plant health • Strong on **downy mildews, white and gray molds**
GRANDEVO	New species of bacteria	Insecticide	• Stops feeding and reproduction of a broad range of **chewing and sucking insects, mites and flies**
VENERATE	New species of bacteria	Insecticide	• Stops development of a broad range of **chewing and sucking insects, mites and flies**
MAJESTENE ZELTO	New species of bacteria	Nematicide	• Controls broad spectrum of root-feeding **nematodes** to increase yields & quality
HAVEN	Coconut oil extract	Crop stress reduction	• **Reduces sun & water stress**, increasing yields & quality
ZEQUANOX	New strain of bacteria	Molluscicide	• Industry's only biological solution **for invasive zebra & quagga mussels**

Bio With Bite® NASDAQ: MBII | 8

It takes about three seasons, with the appropriate climatic conditions, before a product will generate significant revenue. There are field tests, larger scale field trials and finally a season of acceptance by the farmer.

Marrone has several products that are entering this final period. Venerate, which was significant in 4Q18, Majestene and Zelto. Then in 2020 Haven, Stargus and Amplitude kick in. This not to say that these products will not contribute some revenue earlier but the major revenue growth should start in 2020



Until 2018 Regalia was probably the largest seller in Marrone's portfolio of products. It is approved for both conventional and organic crop farming. It is produced from the giant knotweed plant (Reynoutria sachalinensis) a highly invasive weed that grows widely all across Asia. It can grow 6 inches a night.

The product is registered in 16 countries including the US and Canada. Registration is pending in 8 more countries and development is ongoing in at least 10 other countries including China.

Regalia is an effective treatment for powdery mildew and several other diseases and potential markets include almonds, grapes, vegetables, row crops and cannabis.

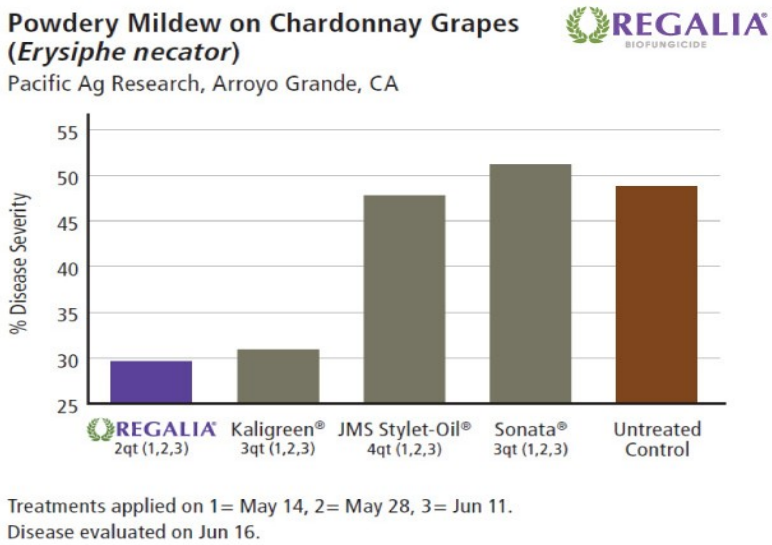
Regalia, which has been improved by several generations since its market introduction, Grandevo and Venerate accounted for 95% of revenue for the 3Q18. However, the seasonality of crop treatments changes the revenue ratios of each product.

The extract is highly effective against powdery mildew. It helps the plant fight the mold rather than attacking the mold directly. When treated with Regalia the plant immune system is stimulated to protect the plant from the attacking disease. Research has proven that the plants produce higher levels of certain proteins and other compounds that inhibit both fungal and bacterial growth.

Marrone has a significant Chinese supplier that acquires the raw plant from numerous suppliers and then extracts the active ingredient with ethyl alcohol and dries the raw material (similar to the procedure used to produce Stevia, a well known sweetener) before shipping it to Marrone Bio Innovations. Marrone keeps an inventory of up to a year's supply to offset any dislocations in the supply chain.

Almonds are a major crop, with most of the production of over 400 million pounds from over 800,000 acres centered in N. California. 100% of domestic almond production is in California, which is also almost 80% of worldwide production. Regalia is effective against powdery mildew; Brown Rot Blossom Blight and Coryneum Shot Hole, which are major pests. Many fungicides have induced resistance in pests on almonds, but Regalia has shown a low risk to the trees developing resistance.

Another important crop is grapes, which can be infected by powdery mildew.



https://marronebioinnovations.com/ag-products/brand/

Powdery mildew is a major problem in the cultivation of cannabis. Cultivation and transport of hemp is now legal under the Farm Act of 2018. In 2018 hemp was grown in 23 states and on 78,176 acres, up from 25,713 acres in 2017 (this excludes marijuana grown under state regulations). The three largest states were Montana (22,000 acres); Colorado (21,578 acres) and Oregon (7,808 acres).

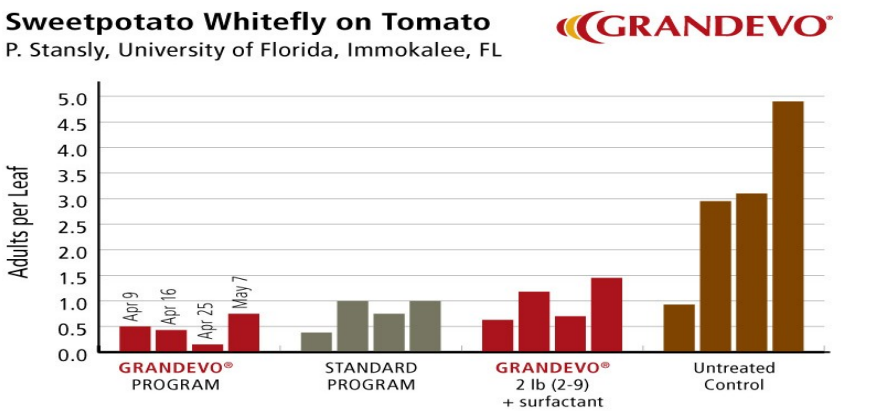
Hemp can be used as a legal supply of CBD (cannabidiol). China dominates the international market for such things as hemp industrial fiber and hemp seed. However, cultivation for CBD requires different methods than cultivation for industrial use and can generate over $60,000 per acre to the farmer.

Pesticide residue is a major problem for cannabis and its derived products. Recent tests in California (San Diego Union Tribune 03/03/2019) discussed the problem. Out of 35,038 samples tested, 3% failed due to the presence of pesticides. This was the second reason for failure after mislabeling the cannabinoids content. Biopesticides do not leave a harmful residue.

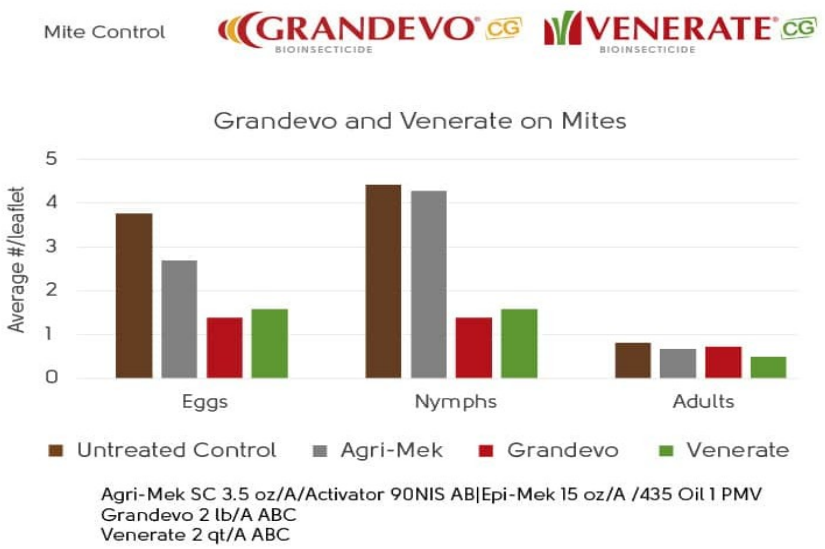
Grandevo® Venerate® and Majestene® are bacterial based pesticides based on adapted versions of earth borne bacteria.

Grandevo is a dead bacteria based on *Chromobacterium (subtsugae)*, one of 11 subspecies of chromobacterium, found in soil. Discovered by the USDA and originally patented by them (US patent 7,244,607 B2) for certain uses as an insecticide. Marrone has patents on the use of the bacteria and associated compounds (fermentation solids) for insect control on corn rootworm, nematodes and several insects and mites.

The bacteria acts as a stomach poison to certain classes of chewing and sucking insects. It is non toxic to humans and is generally benign when applied using spray applications. Its target pests include thrips on strawberries and citrus; whitefly on tomatoes and peppers; spider mites on strawberries (and on cannabis) as well as pests on grapes, peaches and almonds and possibly alfalfa.



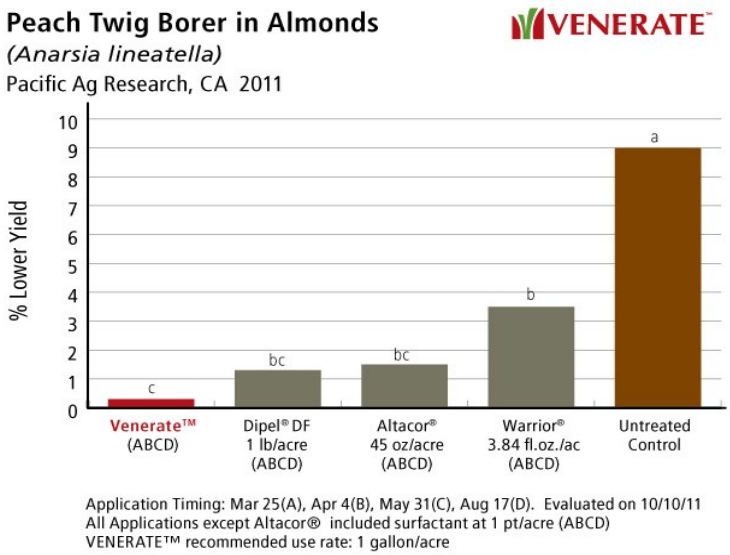
GRANDEVO PROGRAM: Admire® Pro 8.5 fl.oz. (1- soil drench), Grandevo® 2lb + surfactant (4-9), Malathion 32 oz (4), Knack® 10 oz (5), Hero™ 10.3 oz (6,9), Baythroid®XL 2.8 oz (7), Oberon®2 SC 8.5 oz (8)
STANDARD PROGRAM: Admire® Pro 8.5 fl.oz. (1- soil drench), Fulfill 2.75 oz (3), Malathion 32 oz (4), Knack® 10 oz (5), Hero™ 10.3 oz (6,9), Baythroid®XL 2.8 oz (7), Oberon®2 SC 8.5 oz (8)
Treatments applied on 1= Mar 12, 2= Mar 19, 3= Mar 26, 4= Mar 30, 5= Apr 6, 6= Apr 13, 7= Apr 20, 8= Apr 27, 9= May 4, 2012.
Treatment 1 applied at 120 ml/A, treatments 2-7 applied at 40 gpa, treatments 8 and 9 applied at 60 gpa.
Target pest species: *Bemisia tabaci*



It has long been known that members of the family of the bacteria *Burkholderia complex* have insecticidal properties. They are resistant to antibiotics and their associated diseases have such a high mortality rate that pathogenic B.mallei and B.pseudomallei are considered potential biological warfare agents. The agricultural and industrial uses have been severely limited due to their toxicity.

However, Dr. Marrone's R&D team have managed to isolate, and produce, a non pathogenic member of the genus *Burkholderia* which they named as the species of *rinojensis.*

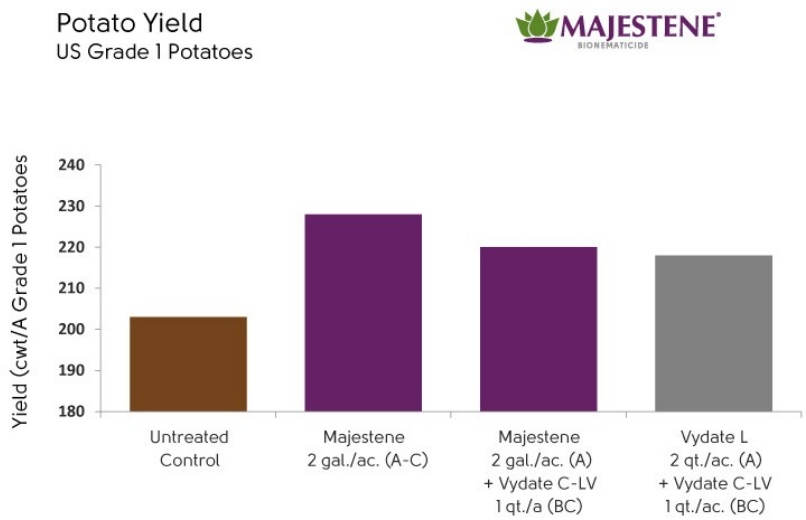
Isolate A396 is the basis for Marrone's Venerate bioinsecticide and Majestene bionematicide.



Venerate is several patented active compounds that are active on contact and by ingestion. It is applied as the killed bacteria in a liquid formulation, registered in the U.S.A. and Mexico and commercial efforts are ongoing in Latin America, Europe, Middle East Africa and Asia.

The formulations have no effect on pollinators but is a broad spectrum insecticide that kills sucking and chewing insects, mites, flies and nematodes. The target pests are essentially the same as for Grandevo.

Majestene is based on the same bacteria as is Venerate, but its applications are based more towards nematodes and seed treatment. There is also a version, Zelto, that is aimed at the domestic and professional turf market.



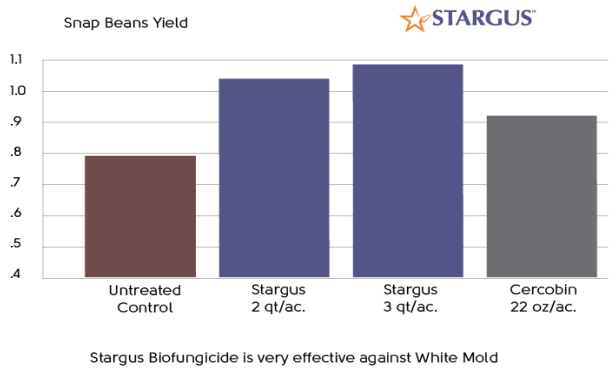
Majestene is as effective as are chemical pesticides in the treatment of soil and seeds.

Stargus® and Amplitude™

Stargus is aimed at specialty crops like leafy vegetables, grapes, apples and fruit, whereas Amplitude is used on row crops, pulse crops [Wikipedia:A **legume** (/□l□□ju□m, lə□□ju□m/) is a plant in the family Fabaceae (or Leguminosae), or the fruit or seed of such a plant (also called a **pulse**], oil seed crops**,** sugar beets.

The primary target is downy mildew, a major plant pathogen that winters in the Southern States and moves north during the spring. Vine crops (grape, hops) and soybeans are very susceptible.

The active ingredient is a new strain of *Bacillus amyloliquefaciens,* F727, a bacterium isolated by MBI scientists from a soil sample in northern California. While this type of *Bacillus* is common in soil, and other biological products contain the same species, MBI's discovery is unique in its high performance on downy mildews, white molds, *Fusarium* and *Botrytis* gray mold, which are particularly difficult to control with both biologicals and chemicals. The bacteria in Stargus work by colonizing plant root hairs, leaves and other plant surfaces, thereby preventing establishment of fungal and bacterial pathogens. The Stargus bacteria also produce natural compounds that inhibit bacterial and fungal growth and spore germination. Further, the bacteria trigger immune responses in the plant to ward off diseases and increase growth and yield, creating a healthier and stronger plant. In Canada, the approved label for Stargus is for the control or suppression of various diseases on cucurbits, legume vegetables, potatoes, grapevines, canola and sunflowers. MBI holds two U.S. patents on the novel strain in the biofungicide product.



Stargus Biofungicide is very effective against White Mold

HAVEN™, a yield and quality enhancer, contains long chain fatty alcohols that, when applied to crops and turf, reduce plant transpiration rates before and during periods of drought stress. Although HAVEN is produced through coconut oil, it can also be made from sperm whale oil. The main ingredient, stearyl alcohol, $CH_3(CH_2)_{16}CH_2OH$, is widely used in cosmetics and lubricants. It is also used as an evaporation suppressant, added to lakes and ponds to reduce evaporation. It is safe and cheap.

Possible markets are Almonds & Pistachios (1,000,000 acres mostly in California, 406000 tonnes of pistachios were produced in the U.S.A. in 2016), grapes (500,000 acres) citrus (100,000 acres), row crops (100 million acres).

Zequanox® molluscicide.

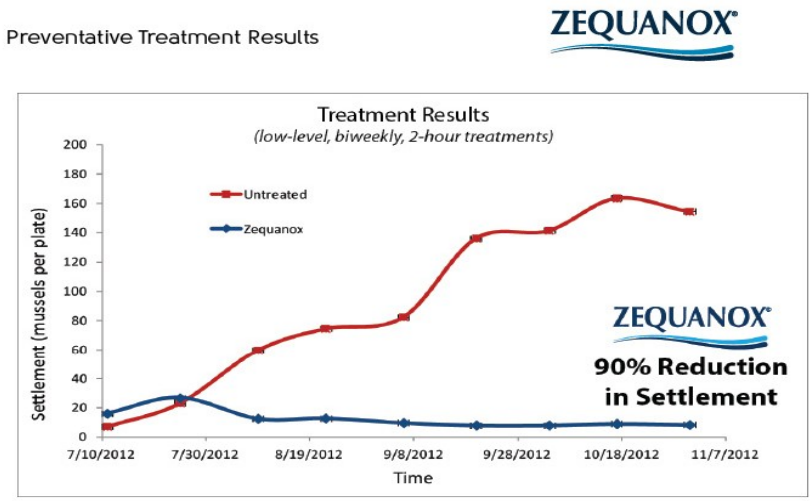
Another result of Marrone Bio Innovations' research is the development of a soil microbe that they found to be an effective control of zebra and quagga mussels. Zequanox does not harm fish or plants.

The active ingredient in Zequanox is composed of dead cells of the soil microbe, *Pseudomonas fluorescens (Pf),* which is ubiquitous in North American freshwaters and soils.

Since their introduction to North America in the mid-1980s, invasive zebra and quagga mussels have been causing significant damage to the ecosystem, to water cooling systems, irrigation water and potable water systems. These tiny mollusks have severely degraded ecosystems, inhibited recreation, and wreaked havoc. It is estimated that the two species cause over $300 million a year in treatment and repair.

Conventional treatment is to use harsh chemicals that themselves cause damage. Marrone has the only non-corrosive safe treatment.

The active ingredient, combined with biological, food grade inert materials, creates a wettable powder end product that has the appearance of freeze-dried coffee. The formulated end product is mixed with on-site water to form a slurry which is then injected into the water system. The invasive mussels respond to the Pf as a food source and will continue to filter feed in the presence of Zequanox, effectively consuming the product along with their regular diet. Once ingested, the product will rupture the stomach lining of the mussels, killing the mussel.



Zequanox is a significant advance in water treatment. It is safe and effective. Moreover the treatment has to be continuously applied to keep the mussels at a safe level. Assuming 10% of the current treatment cost as a reasonable expense to the user, it could generate revenue of $30 million a year to the partnership.

Ennoble™

The first product in the pipeline is the biofumigant Ennoble. It has been EPA approved and should be launched commercially in 2019.

The active ingredient in **Ennoble** is *Muscodor albus,* a naturally occurring endophytic fungus. Marrone screened many *Muscodor* strains to find the best one for development as a reduced-risk biofumigant. *Muscodor albus* SA-13 fits the bill, and testing began in 2014. The company applied for EPA approval in 2015 and received registration in 2016. Marrone expects California approval to follow soon.

Ennoble is non toxic and initial trials showed that it works as well as the leading chemical fumigants.

Seed treatments

Marrone Bio Innovations and Israeli based Ground-work BioAg announced in 2017 the successful field trials of the world's first all-biological comprehensive seed treatment for pest management. The treatments tested in corn and soybeans contained a mycorrhizal inoculant from Groundwork, called Rootella®, as well as a bioinsecticide, a bionematicide, and a biofungicide from Marrone.

The two Biological Stack Seed Treatments (BSST) are comprised of two different insecticidal/nematicidal bacteria, one biostimulant/fungicidal bacterium and mycorrhizal fungi. The addition of Groundwork's mycorrhizae appear to enhance these microbes. According to Marrone Bio Innovations CEO Pam Marrone, the project has potential for high impact in the seed treatment market in general across a broad range of crops, and in particular can meet an unaddressed need for the rapidly growing organic grain segment and regions where pest resistance is an issue.

Corn and soybeans were tested in four Midwestern U.S. states. In corn, the two bio-stacked treatments reduced corn rootworm populations and corn lodging, at least as well or better than the commercial chemical standard. BSST Treatment 1 provided an average increase of 10.9 bushels (+5.8%), and BSST Treatment 2 an average increase of 12.5 bushels (+7.2%). Respectively, these improvements were 3 and 7.4 bushels higher than the commercial standard.

In Aug. 2016 MBII signed an agreement and formed a distribution partnership with Albaugh LLC to develop and market a combined insecticide and nematicide. This was followed in May 2016 with an agreement for Albaugh to sell Grandevo and Venerate in Mexico.

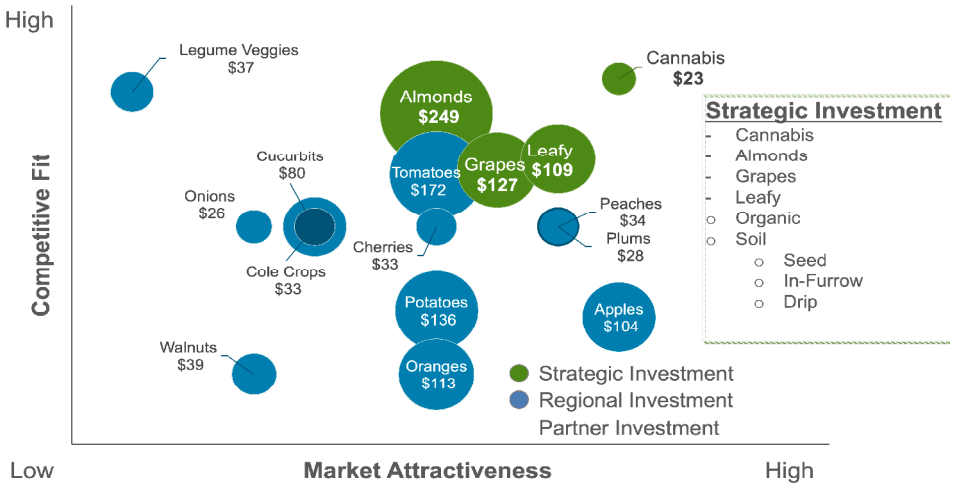
In April 2017 successful field trials of for the world's first all biological seed treatment were completed.

In Dec. 2018 Marrone launched TerraConnect, a new biological soil applied and seed treatment platform delivering high performance products with a broad range of tools to improve and protect crops. TerraConnect is a tailored solution that unites biology and chemistry to protect plants and improve yields.

The seed treatment market is forecast to grow from $6.8 billion in 2017 at an 11% rate.



Marrone Bio Innovations has outlined its potential markets and how attractive each one is for future investments.



The end result of cannabis legislation may be state by state approval of both types of plant, both hemp and marijuana, since recreational use will still be illegal at the federal level. This would lead to regional markets and localized production. The extraction of CBD would occur on a state by state basis. We believe CBD from hemp cannot be distinguished from CBD from any other cannabis plant. The Farm Bill legalized hemp production, that is cannabis with less than 0.3% by volume of THC. MBII is amending its pesticide EPA labels so that they would be allowed for use on hemp.

On April 16, 2018 Marrone Bio Innovations announced that Regalia had been approved for control of powdery mildew on cannabis by Colorado, Oregon, Nevada, and Washington State. It has since been approved in California and most other states where cannabis is allowed

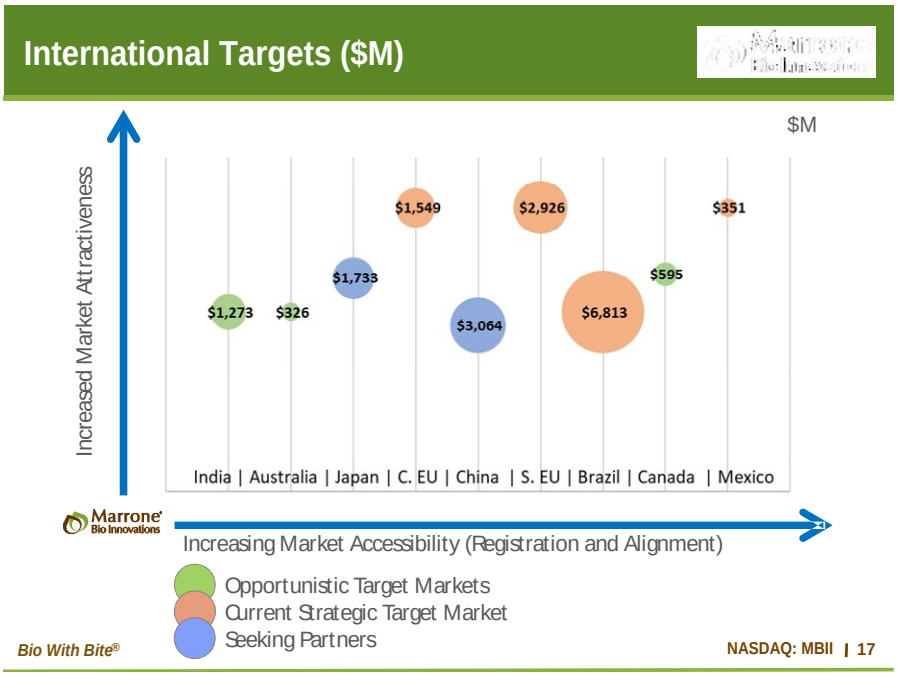
Marrone discussed its current position on cannabis in California on Jan. 18, 2019. The California Dept. of Pesticide, CDP, has confirmed that the use of Grandevo CG is consistent with Food and Agriculture code 12973 in that such use would not conflict with registered labeling for Regalia and Grandevo.

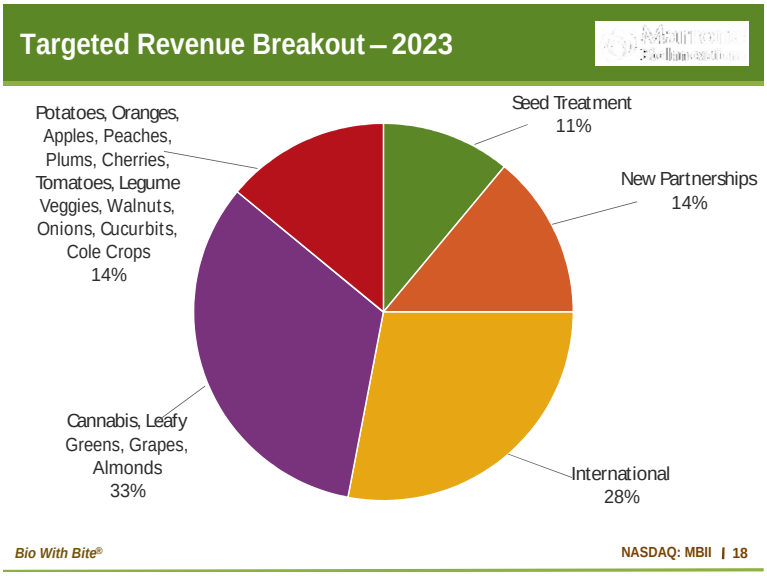
International markets

Marrone is steadily expanding its geographical footprint. Most products have been registered and are on sale in Canada and many in Mexico.

Regalia, Haven and Stargus are on sale in Canada. Venerate and Grandevo, are licensed for sale in Mexico, Majestene and Zequanox are in the registration process.

The largest crop protection market in the world is Brazil, second is the U.S. followed by China, Japan and France. Regalia is registered in Brazil, and Marrone has ongoing programs with field development trials in Brazil, France and China, and trials should start in Japan this year.



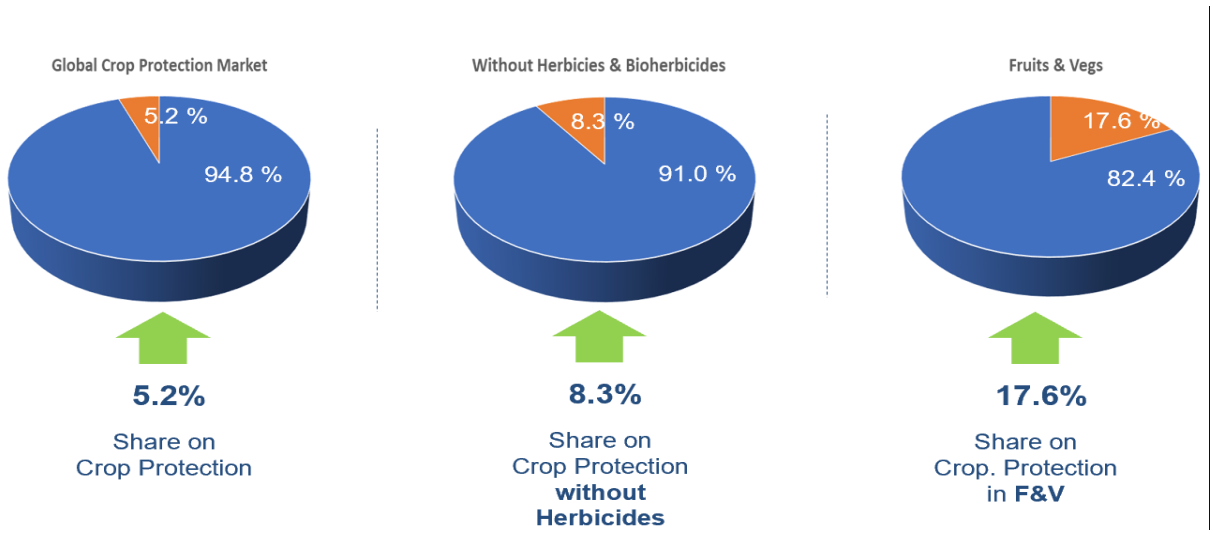


OVERVIEW

Biological pesticides (biopesticides or biocontrol) include several types of pest control that are derived from natural materials such as microorganisms, pheromones to disrupt insect mating, soaps, and some plant extracts. There has been significant work performed on many crops, such as citrus, but the practice extends back over 1,500 years. The first documented report was in about 300 AD involving the control of insects on citrus using ants (source: Wikipedia). In the 1870s predatory mites were shipped from the U.S.A. to France to control a phylloxera that was destroying grape vines.

The overall global crop protection market was about $64 billion in 2017 (DunhamTrimmer, 03/07/2018). The numbers can vary from author to author because the broad definition of crop protection may vary. Excluding herbicides (conventional and bio) the market size is $38 billion and close to a third of this is fruits and vegetables.

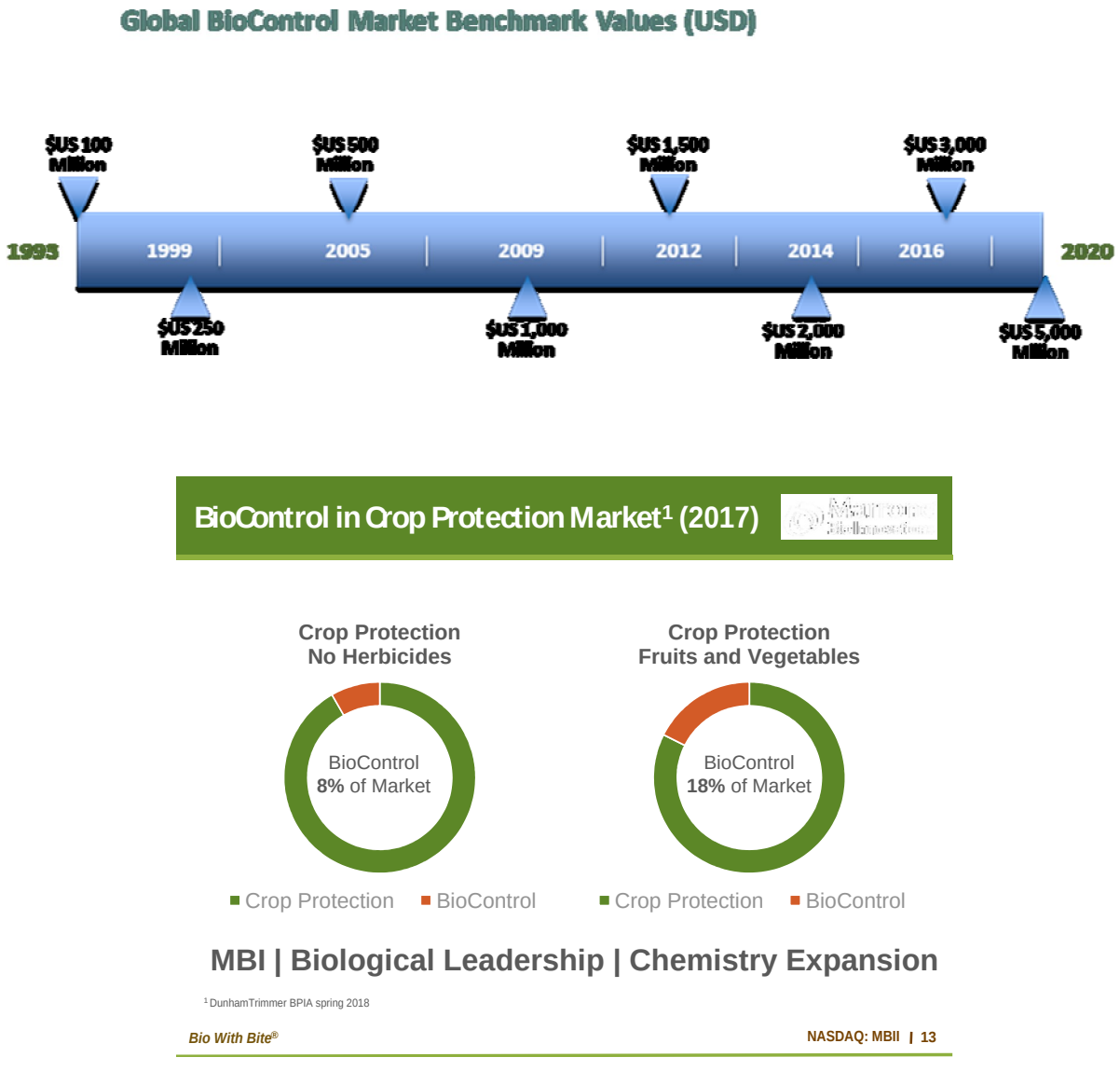
One area of significant interest to Marrone is the fruit, nut and vegetable market.



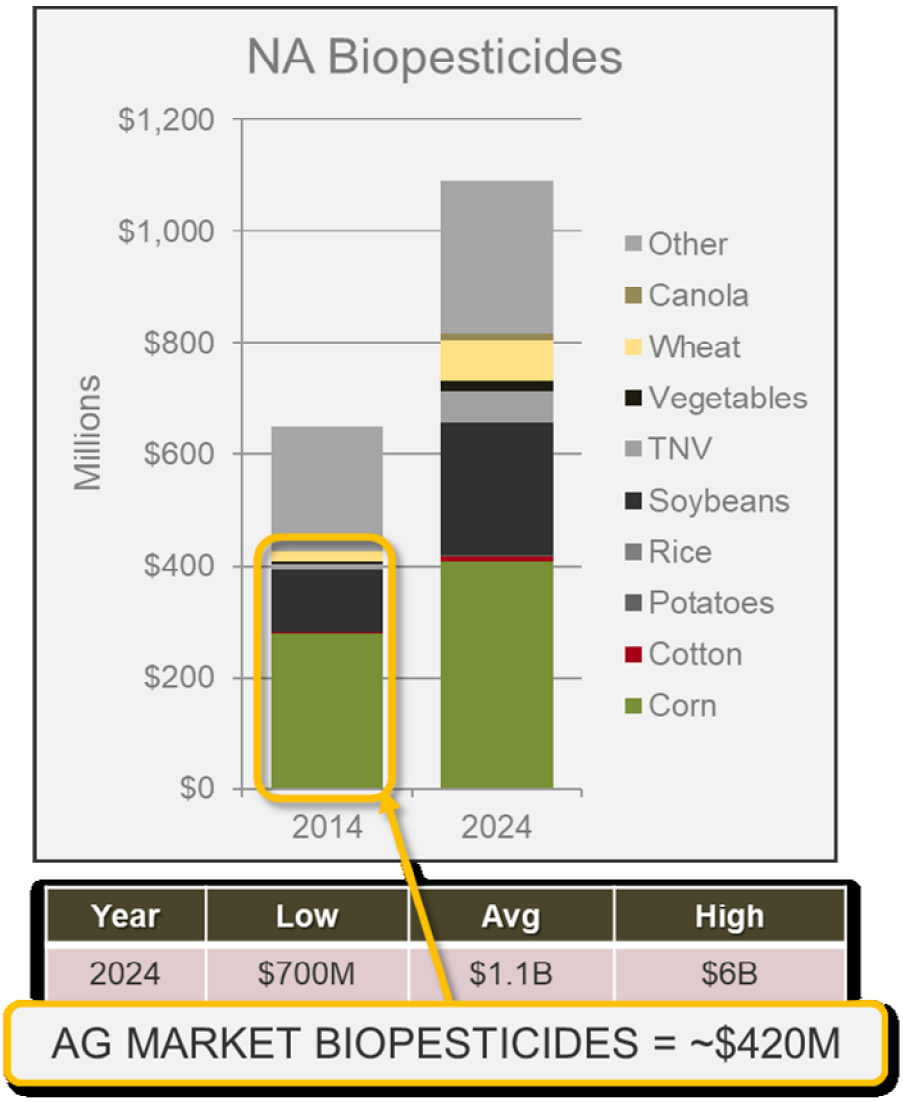
Biocontrol includes abamectin, spinosad, etc

Conventional

The overall pesticide market is estimated to exceed $55 billion (agropages) growing at about 2% a year whereas the biopesticide market is estimated at over $3 billion with a CAGR of between 14% and 18%. Other authors (mordorintelligence.com) estimate that the worldwide market was $2.8 billion in 2017 with South America showing the fastest growth (16.4%) and the United States being the largest market.



There are many pests that cause significant reductions in revenue generated from a crop. Within the United States the top 10 are shown below: Regional differences depend to a certain extent on climate and are also shown. Year to year changes in the weather can impact certain diseases. For example a dry year in California can reduce certain fungi infections. Regional differences may be due to what infestations impact what crops. For example, corn is a major crop in the US but most of the corn is grown in the north central states with very little grown in the arid western states.

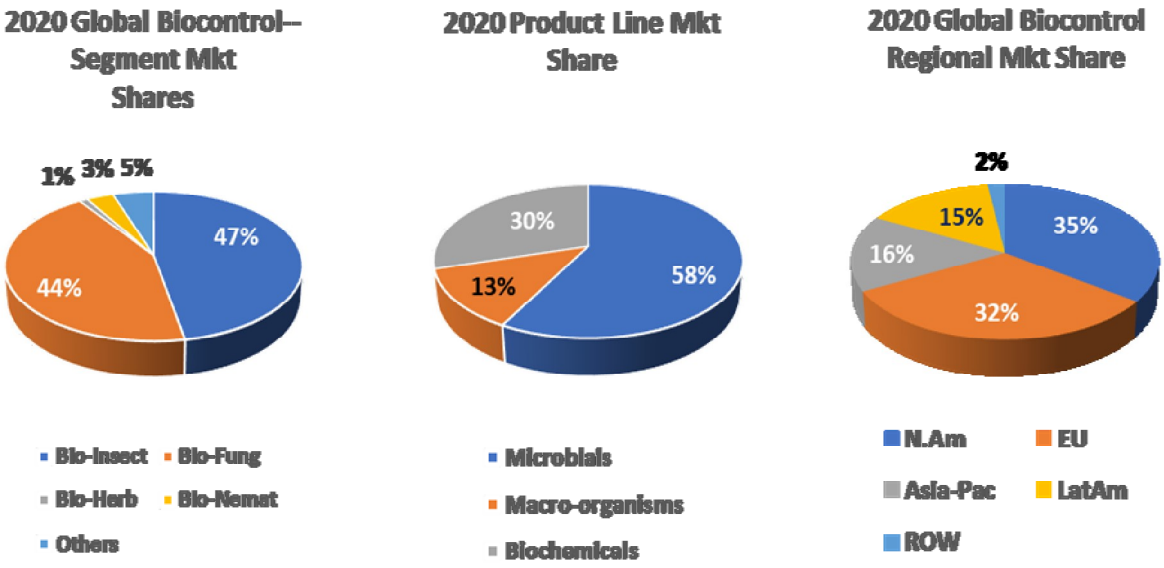


Year	Low	Avg	High
2024	$700M	$1.1B	$6B

AG MARKET BIOPESTICIDES = ~$420M

Over 200 biopesticides are currently sold in the United States, significantly more than the 60 in the EU. More than 225 microbial biopesticides are made in 30 countries within the Organization for Economic Cooperation and Development. About 45% of all biopesticide use is in N. America (NAFTA). According to the authors biopesticides account for about 2% of the global plant protection market. The estimated market in 2022 is $8.8 billion based on a CAGR of 17%. This translates to a market size of $2.9 billion in 2015, $3.4 billion in 2016 and $4.7 billion in 2018. The difference between this and other markets may be due to the definition of the global crop protection market.

(https:// ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=26249),



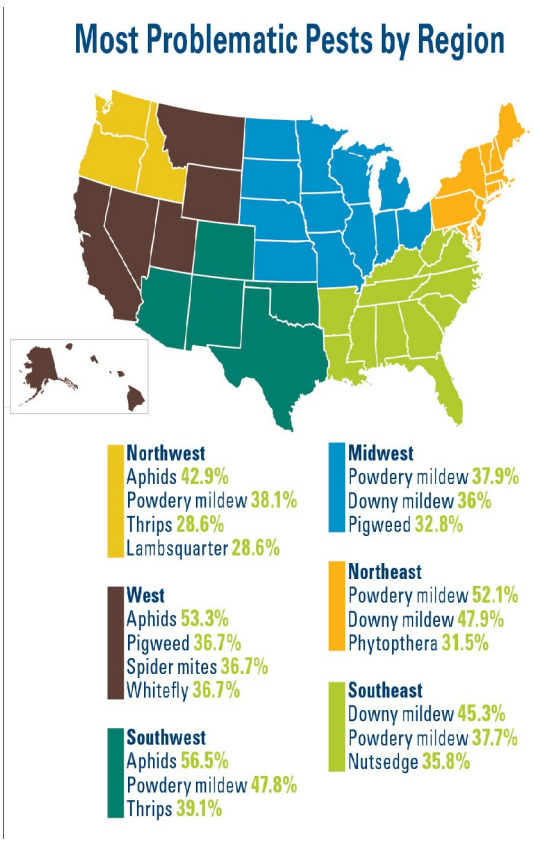
Source Marrone/DunhamTrimmer

Percent of Growers that report having problems with:



Top 10 Pests Nationally

1. Powdery Mildew	40.8%
2. Downy Mildew	37.7%
3. Aphids	32.7%
4. Pigweed	30.8%
5. Thrips	24.6%
6. Lambsquarter	23.1%
7. Squash Bug	22.7%
8. Nutsedge	22.3%
9. Phytophthora	18.5%
10. Spider Mites	18.5%



https://www.growingproduce.com/vegetables/the-top-pests-harming-vegetable-crops-2019-state-of-the-vegetable-industry/

Mildew. Warm and fuzzy.

Two types of mildew are of significant concern to farmers and horticulturists. They are both white fungi, closely related to moulds but differentiated mainly by color. The two are downy mildew, family Peronosporaceae and powdery mildew (a true fungus), Erysiphales. Both types of mildew are parasites that need a plant host to propagate. They penetrate host cells to feed on nutrients and this weakens the plant, which affects crop yield.

Mildew in general is composed of many types of fungi that are usually specific to a narrow range of hosts. Powdery mildew affect flowering plants and downy mildews are a significant problem for potatoes, grape vines and cucurbits (cucumbers, pumpkins, melons and other gourds).

Mildews thrive under certain climatic conditions of temperature and humidity. Downy mildew (being more closely related to algae) prefer 62% to 93% humidity (moist) and 25 degrees to 31 degrees Centigrade (77 to 88 F) whereas powdery mildew does not need water and thrives in a dry climate. Consequently the period in the year when mildew is best treated varies between the two species.



Corn, for example, is afflicted by eight types of downy mildew, Soybeans by one type of downy and one type of powdery mildew.

The fungus attacks the plant through airborne spores, and produce enzymes that break up plant cells and allow the fungi to penetrate and produce roots in the plant. This blocks photo synthesis and weakens the plant. The fungi can extract nutrients directly from the plant.

Aphids: The vampire pest.

Aphids are insects where the females reproduce by both sexual and asexual (cloning) means. The eggs are missing the Y chromosome and so are all females (XX, and males have only one X). They reproduce rapidly and can become serious threats if not treated quicky. Aphids are sucking insects that cause plants to weaken and reduce yields. There are over 5,000 types of aphids, many are plant specific, some use two plants during their life cycle.

Other sucking insects such as mites, ticks and thrips are significant threats to corn and soybean crops. Hot & dry midyear weather in the Midwest favours mite infestations.

Sucking insects are best treated using systemic insecticides. Bacterial treatments have long been used as biological control. Bacillus thuringiensis, a soil dwelling bacteria, and its sub species are available as dried spores.

Nematodes:

These are wormlike pests that feed on living plants.

Nematodes are microscopic, wormlike creatures which inhabit the soil and damage the roots of plants, impairing their ability to take up water and nutrients. Symptoms of this damage include stunting, yellowing of plant leaves, and loss of plant vitality. They may work themselves into a root. The results may be lesions and galls on the roots

Plant pests (weeds):

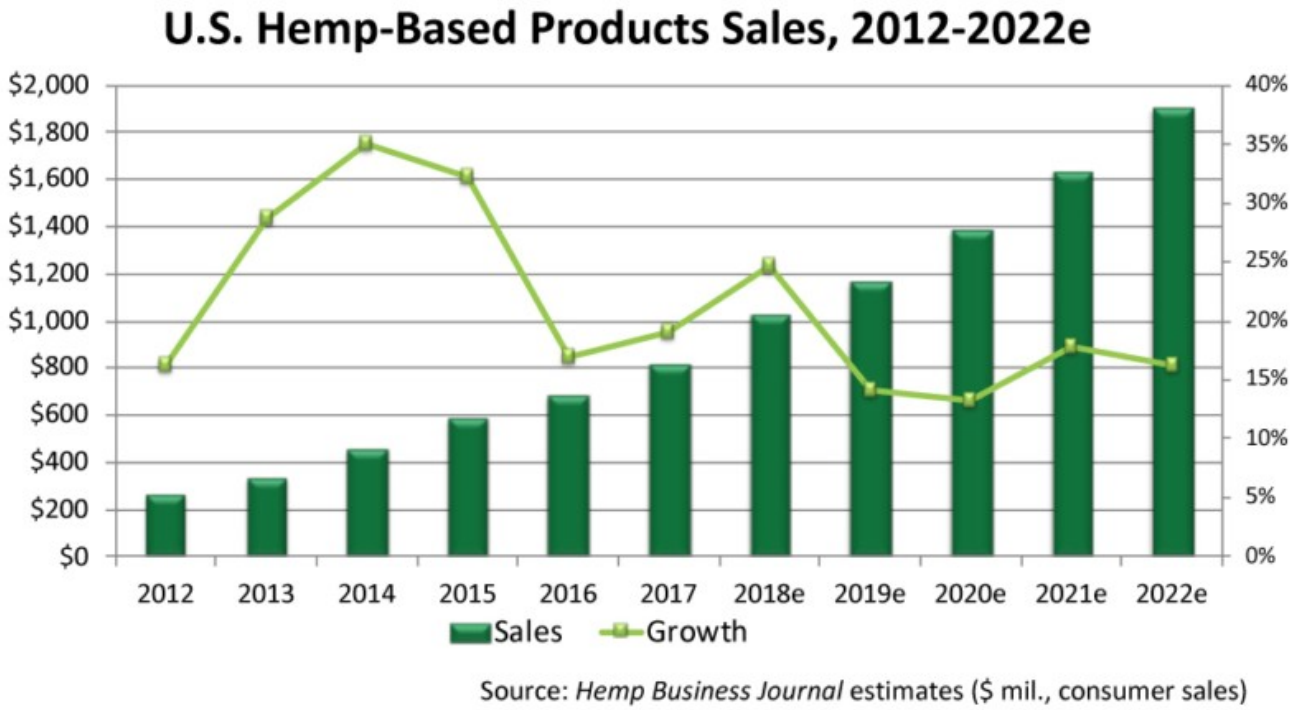
There are many plants that are serious threats in agriculture. These include pigweed (***Amaranths),*** tumbleweed (Russian thistle), nutsedge, lambsquarter, goosefoot. They may not all be treatable with chemical herbicides, but some biological control has been used. Many noxious weeds have developed resistance to such chemical herbicides as glyphosphate (Roundup).

Cannabis:

At the federal level hemp is legal. Marijuana is not. CBD may be. State programs, not yet. The current legal situation is confusing, but Canada is a large potential market.

The cannabis industry has received a great deal of attention over the past few years. It is an important crop and likely to become even more so. It is potentially a major source of revenue to Marrone Bio Innovations. As such we intend to outline the current situation and future prospects as we see them in more detail than we normally would.

It is estimated that 55 million Americans are current recreational users of marijuana. The United States is the second highest user of weed in the world. Canada is in the top 10. Fortune has estimated that the yearly sale of marijuana in the U.S. is currently $8 billion to $10 billion. All uses of hemp, on the other hand, is estimated to be $1 billion in 2018.



On Dec. 20, 2018 the Farm Bill became Law. This legalized industrial hemp, a member of the cannabis family, as defined as "less than 0.3% delta-9 THC (THC is the psychotic drug). At this level the plant is non-intoxicating. Above this level the plant is illegal according to Federal Law. The law also included hemp based products such as CBD when derived from hemp and not from marijuana. [https://www.natlawreview.com/article/2018-farm-bill-legalizes-hemp-obstacles-to-sale-cbd-products-remain; March 05, 2019]

However, many States have passed laws that make the sale of marijuana, a different species of the plant, legal. The psychoactive effects are not apparent until the THC content exceeds 10%. A good quality marijuana bud may contain 35% psychoactive compounds.

[https://www.brookings.edu/blog/fixgov/2018/12/14/the-farm-bill-hemp-and-cbd-explainer/]

Furthermore, under section 10113 of the Farm Bill, to implement a hemp based program state departments of agriculture must consult with the state's governor and chief law enforcement officer to devise a plan that "must be submitted to the Secretary of USDA". Such a plan can ONLY commence when the plan is approved by the USDA. No plan-No hemp.

As a result all current state plans are illegal until such a plan has been submitted and approved.

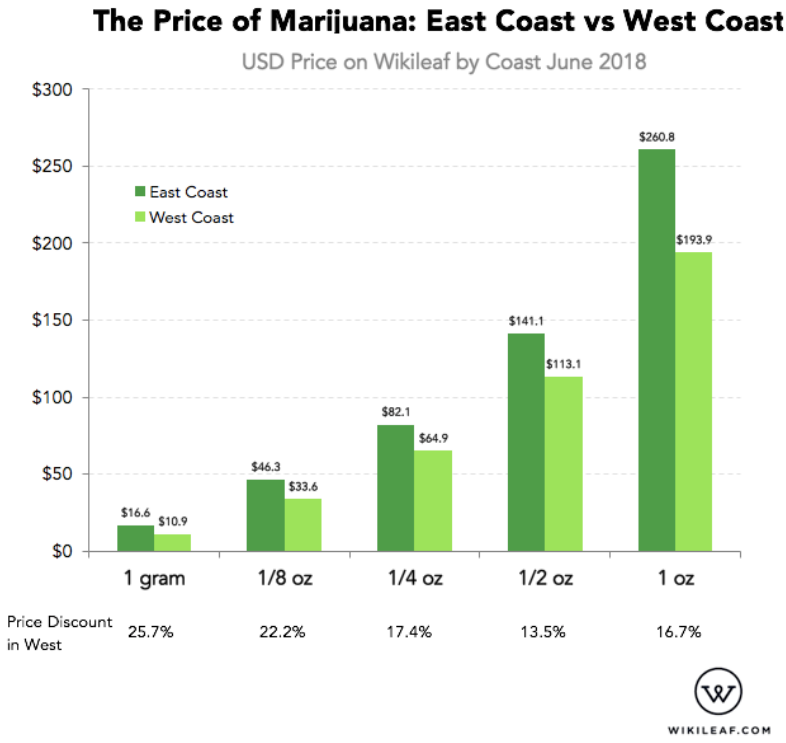
A cannabis plant may be legal at the State level but illegal at the Federal level. This means that marijuana or products derived from cannbis cannot be transported across state lines. This includes CBD. All cannabis plants and products may be illegal.

Then there is the FDA! In a statement made by the FDA Commissioner on Dec. 20, 2018 it was stated that "it is unlawful under the FD&C Act to introduce food containing added CBD or THC into interstate commerce, or to market CBD or THC products as, or in, dietary supplements". Currently CBD is not authorized to be a dietary supplement or to be used in food. In other words, CBD is illegal no matter what plant it comes from if it is used as a medicine or food supplement CBD remains a Schedule I substance under federal law.

Assuming that recreational marijuana is legalized under federal law the question becomes one of supply. There is currently, albeit illegal, transportation of marijuana through and from Mexico into the United States. This is unlikely to stop if marijuana is legalized at the federal level. Although the current product is mainly low quality and marijuana is illegal in Mexico, the potential of production in Latin Americas for the American market still exists. The current growth in the United States may be due solely to the transfer from an illegal market to a state legal one and not to any growth in overall marijuana consumption.

The legal sale of cannabis is heavily taxed. This is, or may become, a major source of income to the states. It is to the states benefit to file plans asap and become legal. The problem with CBD is more complex and it may not be possible to have CBD declared GRAS.

On March 14, 2019 Terra Tech (OTCQX: TRTC) stated that the revenue shortfall in 4Q 2018 was due to the significant level of taxes the State of California placed on Cannabis, which depressed the legal market.



The Price of Marijuana: East Coast vs West Coast Cities

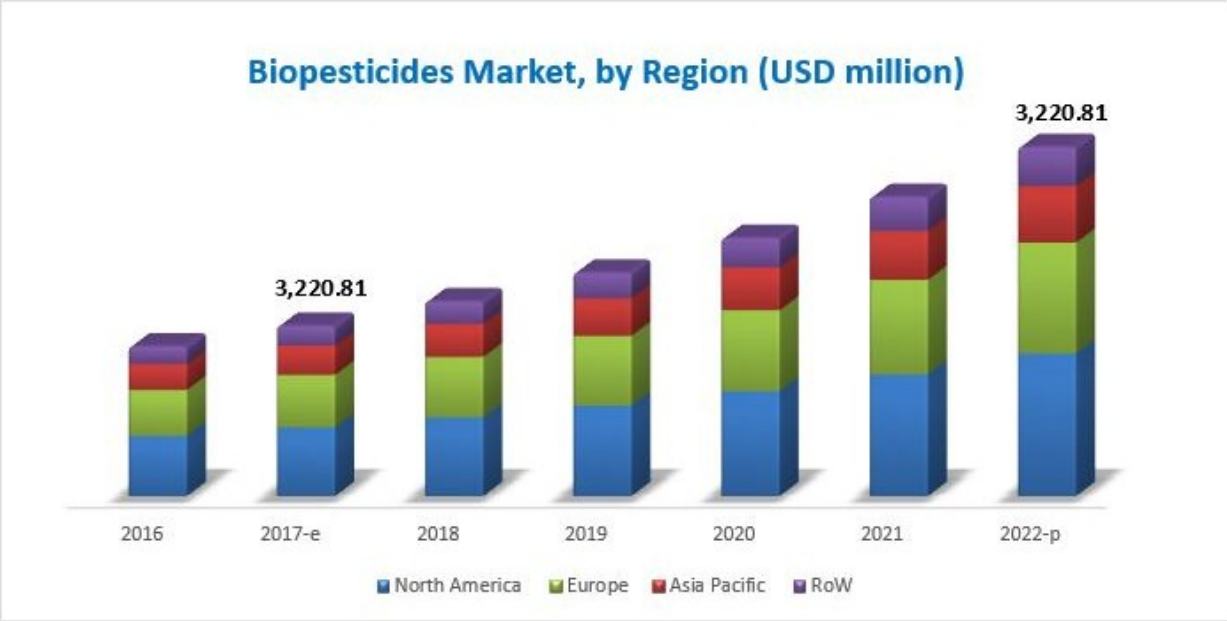
USD Price of 1/8 of an ounce on Wikileaf June 2018

Rank	City Name	State Name	$ Price
1	Baltimore, MD	East	$53.7
2	Boston, MA	East	$48.3
3	San Francisco, CA	West	$43.6
4	Seattle, WA	West	$37.9
5	Portland, ME	East	$37.0
6	Los Angeles, CA	West	$35.7
7	Denver, CO	West	$32.1
8	Portland, OR	West	$30.6

WIKILEAF.COM

In March 2019 an ounce of Acapulco Gold cost about $320 in NYC. That's over $10,000 a kilo. A "square grouper" may weigh over 30 Kg. No wonder cannabis stocks are popular. But, it is still illegal for recreational marijuana to cross state lines. Fortunately Marrone Bio Innovations should benefit no matter whether hemp is the only crop and is well prepared for greenhouse cultivation.

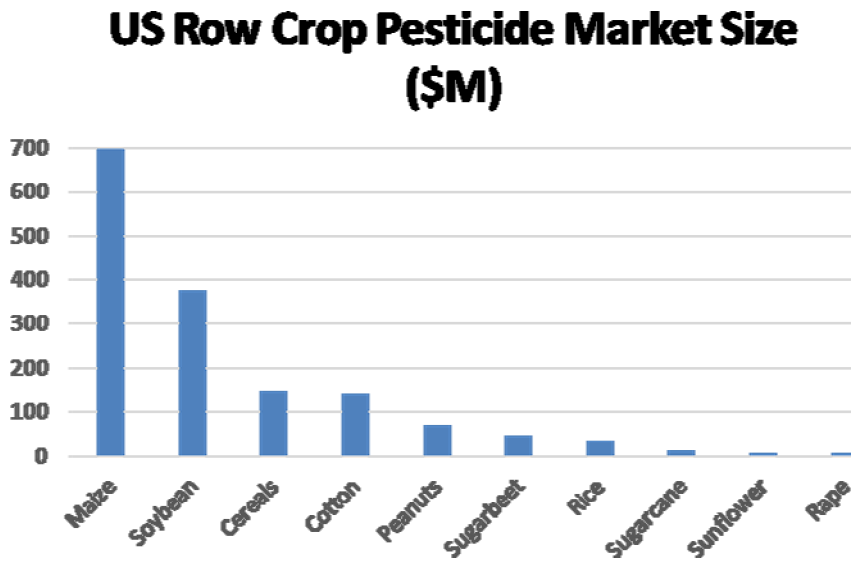
INDUSTRY OUTLOOK



One driver of alternatives to chemical pesticides is the demand for organic foods and, therefore, chemical fertilizer (NPK) and organic farming without chemical pesticides



Pesticide treatment is based on acres treated. The market opportunity to companies like Marrone Bio Innovations depends on which pest needs to be treated at a reasonable cost and how many acres can be treated at the time of infestation.



Corn is the US name for maize

INDUSTRY POSITION

Over the years a significant industry has emerged with estimated revenue of over $4.7 billion in 2018 growing at close to 17% a year. It is estimated that there are over 400 companies involved, with 98% of them being privately owned (Dunham Trimmer).

Based on estimated sales of those companies owned by the large ag chemical companies, Marrone Bio Innovations has been ranked in the lower half of the top ten companies.

VALUATION

There are no public companies like Marrone Bio Innovations. The characteristics of MBII are more like a pharmaceutical company than an agricultural or food additive company. The comparison list are companies with some agricultural operations

COMPARISON TABLE	Ticker	Price	Mkt	P/B	P/S	EV/Sales	Inst.	Insider
(Source: Yahoo Finance)		4/1/19	Cap	LQ	L4Q	L4Q	Ownership %	Ownership %
			(in million)					
Marrone Bio Innovations.	**MBII**	**$1.42**	**$157.2**	**8.71**	**7.41**	**6.44**	**79.90**	**1.10**
Calyxt Inc	**CLXT**	$16.66	$544.3	5.82	2306.00	2061.00	27.20	70.40
Evogend Ltd.	**EVGN**	$2.37	$59.3	1.22	33.95	3.46	N/A	N/A
Yield10 Bioscience	**YTEN**	$1.21	$15.0	2.11	27.02	10.18	77.70	3.80
Mean				4.47	593.59	520.27		
Median				3.97	30.49	8.31		

RISKS

Near term profitability is unlikely, and Marrone Bio Innovations may need another funding before the end of 2021.

There is uncertainty about the company's ability to continue as a going concern

Sales growth is essential to survival.

Marrone Bio Innovations ahs limited experience in marketing and selling and will need to expand sales and marketing infrastructure.

Customer concentration. 63% of 3Q18 revenue went to three customers, and 64% of accounts receivable were from the same three customers. For the full year 2018 52% of the total revenue was to the top two distributors.Loss of one of these customers would have a significant impact on MBII.

All products require registration which could be withdrawn if the products are considered to be unsafe to the environment, to the public or cause harm when used in conjunction with chemical pesticides.

INSIDER TRADING AND OWNERSHIP

As of the date of initiation of this report (as % of all shares) :

All Insiders: 2.16

Institutions: 79.84 65 Institutions held shares.

As % Float: Institutions owned 81.61

The proxy statement dated 04/20/2018 listed shares owned as:

Ospraie Ag. Science & affiliates		61,333,334	
Waddell & Reed Financial		28,714,892	
Ardsley Advisory Partners		15,681,580	
Van Herk Investments B.V.		12,477,481	
Pamela G. Marrone Ph.D.	CEO	1,325,766	
James B. Boyd	CFO	510,658	
All directors and executive officers as a group		3,014,287	2.9%

PROJECTED INCOME STATEMENT & BALANCE SHEET

Marrone Bio Innovations, Inc																														
Consolidated Statements of Operations																														
(Dollars in millions except per share data)																														
Fiscal Year December.	2013A	2014A	2015A	1Q16	2Q16	3Q16	4Q16	2016A	1Q17	2Q17	3Q17	4Q17	2017A Act.	1Q18	2Q18	3Q18 Act	4Q18 Est	2018 E	1Q19	2Q19	3Q19	4Q19	2019 E	1Q20	2Q20	3Q20	4Q20	2020 E	2021 E	2022 E
Revenue	**$8.45**	**$9.14**	**$9.80**	**$2.67**	**$5.05**	**$3.63**	**$2.69**	**$14.04**	**$4.15**	**$6.48**	**$4.22**	**$3.32**	**$18.17**	**$4.32**	**$5.75**	**$5.43**	**$4.50**	**$20.00**	**$6.00**	**$8.50**	**$8.00**	**$6.00**	**$28.50**	**$8.00**	**$9.50**	**$9.00**	**$7.50**	**$34.00**	**$39.00**	**$42.94**
% Change				0.00	0.00	0.00	0.00	43.27	55.64	28.26	16.10	23.35	29.38	4.09	(11.18)	28.58	35.62	10.09	38.76	47.77	47.47	33.33	42.50	33.33	11.76	12.50	25.00	19.30	14.71	10.10
Cost of product	6.87	8.88	9.00	2.27	3.12	2.49	1.64	9.52	2.28	3.97	2.49	1.79	10.53	2.24	3.03	2.80	2.30	10.38	3.00	4.34	4.00	2.82	14.16	4.00	4.75	4.50	3.50	16.75	19.33	21.47
S.G & A	15.02	28.95	26.50	5.53	4.51	3.75	4.71	18.51	5.34	5.07	5.17	4.22	19.81	5.02	4.72	4.12	4.40	18.26	4.50	5.00	4.53	4.84	18.87	4.95	5.00	5.00	4.70	19.65	20.50	20.00
In process R&D	0.37	0.56	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R&D	17.91	19.28	13.50	2.32	2.31	2.66	2.37	9.67	2.44	2.85	3.15	2.37	10.82	2.53	2.49	2.66	2.20	9.89	2.60	2.50	2.60	2.40	10.10	2.47	2.38	2.47	2.28	9.60	9.12	8.66
Depr. & Amort.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Op Income GAAP	(31.72)	(48.53)	(39.46)	(7.45)	(4.89)	(5.28)	(6.04)	(23.66)	(5.91)	(5.42)	(6.60)	(5.07)	(23.00)	(5.48)	(4.49)	(4.15)	(4.40)	(18.52)	(4.10)	(3.34)	(3.13)	(4.06)	(14.62)	(3.42)	(2.63)	(2.97)	(2.98)	(12.00)	(9.95)	(7.19)
Interest Expenses	6.06	2.91	4.36	1.83	1.84	1.85	1.77	7.30	1.71	1.95	1.90	2.16	7.73	1.55	0.36	0.30	0.30	2.51	0.50	0.50	0.50	0.50	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest Income	0.05	0.06	0.05	0.02	0.01	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Op Income	(0.28)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.10)	(0.10)	4.14	0.00	0.00	0.00	4.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	6.77	(0.28)	0.04	(0.01)	(0.06)	(0.08)	(0.00)	(0.15)	(0.01)	(0.02)	0.00	(0.05)	(0.11)	(0.03)	0.00	0.01	0.00	(0.01)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calc.Pretax	(31.24)	(51.66)	(43.73)	(9.28)	(6.78)	(7.20)	(7.81)	(31.07)	(7.63)	(7.39)	(8.50)	(7.38)	(30.93)	(2.92)	(4.84)	(4.44)	(4.70)	(16.90)	(4.60)	(3.84)	(3.63)	(4.56)	(16.62)	(3.42)	(2.63)	(2.97)	(2.98)	(12.00)	(9.95)	(7.19)
Taxes	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax Rate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Income	(1.38)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pro-forma adj.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Income	32.62	(51.66)	(43.73)	(9.28)	(6.78)	(7.20)	(7.81)	(31.07)	(7.63)	(7.39)	(8.50)	(7.38)	(30.90)	(2.92)	(4.84)	(4.44)	(4.70)	(16.90)	(4.60)	(3.84)	(3.63)	(4.56)	(16.62)	(3.42)	(2.63)	(2.97)	(2.98)	(12.00)	(9.95)	(7.19)
Costs and expenses are on a pro-forma basis																														
Net For Common	(32.62)	(51.66)	(43.73)	(9.28)	(6.78)	(7.20)	(7.81)	(31.07)	(7.63)	(7.39)	(8.50)	(7.38)	(30.90)	(2.92)	(4.84)	(4.44)	(4.70)	(16.90)	(4.60)	(3.84)	(3.63)	(4.56)	(16.62)	(3.42)	(2.63)	(2.97)	(2.98)	(12.00)	(9.95)	(7.19)
Shares Used, millions, basic	0.00	0.00	0.00	24.50	24.50	24.50	24.50	24.62	24.74	29.40	31.35	30.76	29.24	74.59	108.65	110.57	112.00	101.50	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00
Earnings Per Share																														
EPS	**$0.00**	**$0.00**	**$0.00**	**($0.38)**	**($0.28)**	**($0.29)**	**($0.32)**	**($1.26)**	**($0.31)**	**($0.25)**	**($0.27)**	**($0.24)**	**($1.06)**	**($0.04)**	**($0.04)**	**($0.04)**	**($0.04)**	**($0.17)**	**($0.04)**	**($0.03)**	**($0.03)**	**($0.04)**	**($0.15)**	**($0.03)**	**($0.02)**	**($0.03)**	**($0.03)**	**($0.11)**	**($0.09)**	**($0.06)**
Pro Forma EPS, adjusted	**($4.25)**	**$0.00**	**$0.00**	**($0.38)**	**($0.28)**	**($0.29)**	**($0.32)**	**($1.26)**	**($0.31)**	**($0.25)**	**($0.27)**	**($0.44)**	**($1.06)**	**($0.04)**	**($0.04)**	**($0.04)**	**($0.04)**	**($0.17)**	**($0.04)**	**($0.03)**	**($0.03)**	**($0.04)**	**($0.15)**	**($0.03)**	**($0.02)**	**($0.03)**	**($0.03)**	**($0.11)**	**($0.09)**	**($0.06)**

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BALANCE SHEET

Marrone Bio Innovations Inc							
Fiscal Year December.							
	4Q15	**4Q16**	**4Q17**	**1Q18**	**2Q18**	**3Q18**	**4Q18**
ASSETS							
Cash & Equiv.	21.69	11.05	1.27	14.76	23.30	20.52	18.22
A/R	2.35	3.59	3.79	4.35	4.72	3.07	2.72
Inventories	9.06	8.48	9.83	10.05	9.18	8.84	8.22
Other	2.81	3.75	4.23	1.27	0.77	1.34	0.97
Total current assets	$35.91	$26.88	$19.12	$30.43	$37.97	$33.78	$30.14
Gross Plant	18.45	17.34	16.02	15.70	15.28	14.87	14.51
Acc. Deprn	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restricted Cash	16.56	1.56	1.56	1.56	1.56	1.56	1.56
Intangibles	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.28	0.21	0.22	0.34	0.34	0.33	0.36
All Assets	$71.20	$45.98	$36.91	$48.03	$55.14	$50.54	$46.57
LIABILITIES AND NET WORTH							
Debt Due 1 Yr		0.25	1.52	1.85	2.61	1.74	2.32
Notes Payable		0.00	0.00	0.00	0.00	0.00	0.00
A/P	2.01	1.39	3.80	2.62	1.49	1.86	1.69
Deferred Revenue	2.92	5.65	6.19	0.00	0.36	0.36	0.44
Other	7.92	7.97	10.49	7.11	5.99	5.93	6.87
Total current liabilities	$12.85	$15.25	$22.00	$11.58	$10.44	$9.89	$11.32
Related party debt	35.51	36.67	37.82	7.29	7.30	7.30	7.30
L.T.Debt	21.06	21.08	24.41	11.97	11.93	11.88	11.82
Other LT	2.02	1.79	2.05	2.51	2.67	2.63	2.40
Def. Taxes & ITC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	1.33	1.38	1.29	0.92	0.84	0.79	0.79
All Liabilities	$73.22	$76.17	$87.56	$34.28	$33.18	$32.50	$33.63
Pref.Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Common Stock	201.55	204.46	214.92	279.93	292.99	293.51	296.41
Surplus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Retained Earnings	-203.58	-234.65	-265.57	-266.18	-271.02	-275.46	-283.48
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Treasury Stock	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Worth	-2.02	-31.18	-50.65	13.75	21.96	18.04	12.93
Total liabilities & stockholders' equity	$45.98	$45.98	$36.91	$48.03	$55.14	$50.54	$46.57

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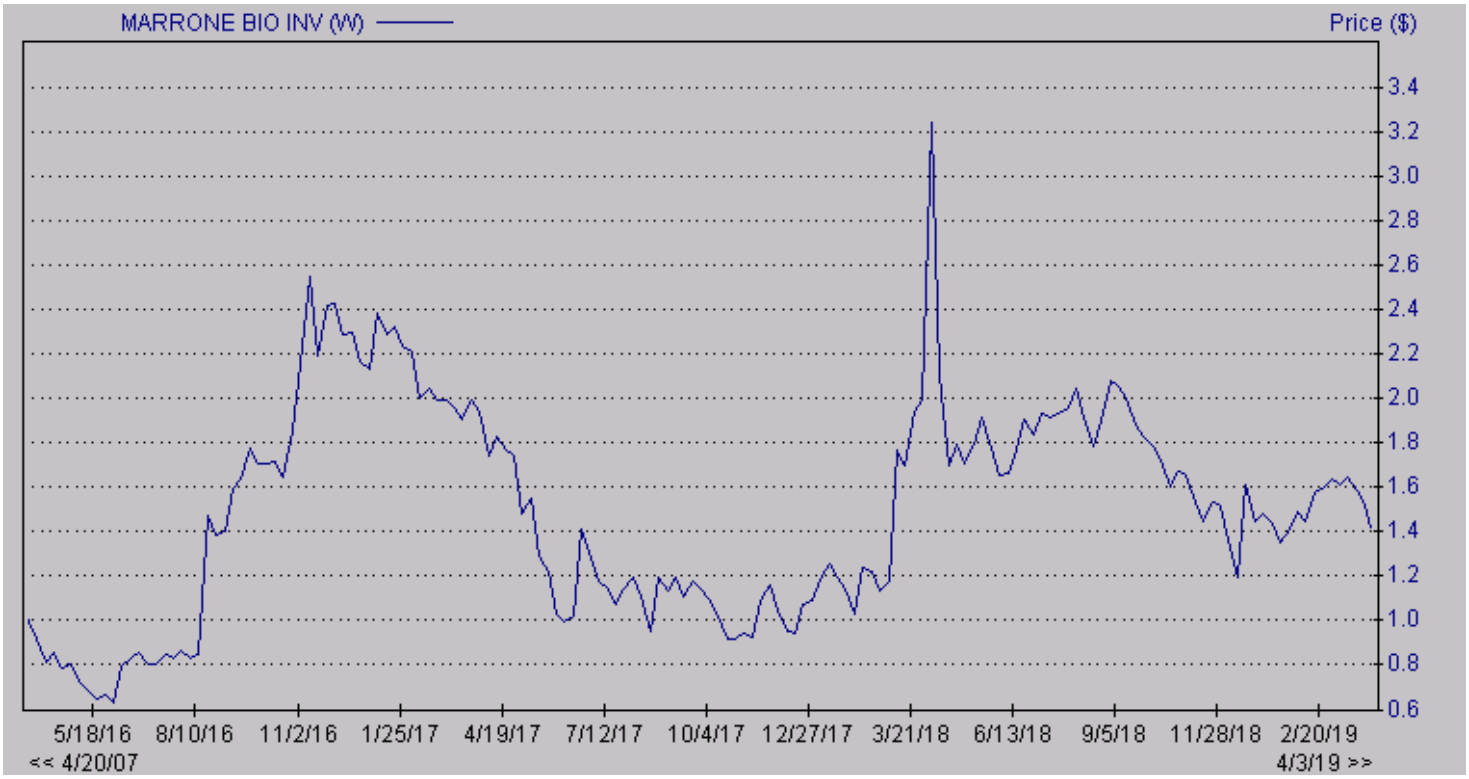
SOURCE & USE of FUNDS

Marrone Bio Innovations.				
Condensed Consolidated Statements of Cash Flows				
Fiscal Year December.				
	2015	**2016**	**2017**	**2018**
Cash flow from operations:				
Net (Loss) Income	-43.73	-31.07	-30.93	-20.21
Depreciation & amortization	3.51	2.24	2.04	1.89
Amortization of goodwill				
Stock issued for services				
Stock based compensation	3.81	2.67	2.11	1.85
Impairment of machinery				
In-process R&D				
Other	0.24	1.86	5.71	-2.95
Net cash provided by (used in) operating activites	**($36.17)**	**($24.30)**	**($21.05)**	**($19.43)**
Cash flow from investments:				
Purchase of PP&E	(1.65)	(0.21)	(0.85)	(0.60)
Proceeds from disposal of PP&E				
Other				
Net cash provided by (used in) investing activities	**($1.65)**	**($0.21)**	**($0.85)**	**($0.60)**
Cash flow from financing activities:				
Proceeds from issuance of common stock			8.19	34.49
Proceeds (payment) on lines of credit, net			1.30	0.80
Proceeds from debt - related parties				
Proceeds from debt	39.67		4.00	2.00
Payment on debt - related parties				
Payment on debt				
Other	(17.34)	14.29	(1.48)	(0.33)
Net cash provided by (used in) financing activities	**$22.33**	**$14.29**	**$12.01**	**$36.95**
Increase (decrease) in cash and equivalents	($15.49)	($10.23)	($9.89)	$16.93
Cash & equivalents at beginning of period	$35.32	$19.84	$12.60	$2.83
Cash & equivalents at end of period	$19.84	$9.61	$2.83	$19.76

HISTORICAL STOCK PRICE



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