Semilla Nueva Standard Report
January – June 2019

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NOTE FROM THE EXECUTIVE DIRECTOR

Semilla Nueva is trying to do what no one in the world has yet figured out—how to get small farmers in one of the most malnourished countries in the world to buy maize seeds with more protein and zinc. Every year, we have a double challenge. On one hand, we need to reach more families, improve the seeds we offer, and get more nutrients to more kids—all while decreasing the cost per family served and pursuing sustainability. On the other hand, we also have to develop the technologies to make it easier for other seed companies to join the effort—and then get them on board.

Why? There are 900 million people eating maize daily, in some of the most malnourished countries on the planet. Due to population growth, the total number of malnourished people eating maize is actually increasing. Meaning, that population will be 2 billion in only a few decades. There is no way we will ever reach those people alone—and so we need to develop the tools to change the seed industry.

What I hope you gain from this report is a glance into our work on both ends. We are directly selling biofortified seeds to small farmers to learn how to make it work. We're creating new marketing strategies, finding product defects, and developing the world's first impact models for protein and zinc biofortified maize. And we are also developing new tools to speed up the development of better and more acceptable biofortified seeds—tools which will not only help us, but enable the rest of the world to more easily copy us.

Where we are today, what we have been able to do, is largely thanks to the organizations and individuals who have invested in us, mentored us, advocated for us, and pushed us. We have had needs that have been covered by grants at exactly the right time. We have had hard conversations that have helped us rethink strategies. All of that is possible only by us sharing our best analysis of where we are—and then working to continue this adventure together.

Thank you all for all that you have done,

-Curt

EXECUTIVE SUMMARY

This report marks the midpoint of Semilla Nueva's 2nd full year selling biofortified maize seed in Guatemala. The last six months have largely been a success, but they also shown critical areas that will require focus and adjustments to our model.

Production: Semilla Nueva began producing seed in a new region, more than doubling our slim profit margin. Seeds were produced on time and beat every company we tested in seed quality.

Sales: In 2018, we sold 1,245 bags of our Fortaleza F3 seed. This year we are on track to double those sales, with 1,721 bags of seed by June 30, 2019. Eastern Guatemala is showing good commercial potential with most 2018 customers repeating purchases. However, repeat purchases were uncommon in the Southern Coast and Northern Guatemala, because grain buyers had penalized farmers for the physical appearance of the protein biofortified grain farmers produced. As a result, we are on track to meet our original goals for 2019, but not the optimistic, elevated goals we established at the end of 2018. To mitigate this problem, we are now focusing more of our sales efforts on Eastern Guatemala, working to improve our sales systems, and preparing to test a new plan to launch a new high zinc hybrid in areas where intermediaries penalized Fortaleza F3.

Research and Development: Semilla Nueva launched a new program to develop biofortified seeds that could compete for yield with the best seeds currently in the market—and we're laying the groundwork to launch our nutrition lab. We also have six new seeds in evaluation. One that could be tested in scale and launched in 2020 with sales in 2021, and the others following a year later. In addition, we are working to develop new technologies, biofortification through zinc fertilization and new biological control methods against aflatoxins.

Impact Evaluation: We reached potentially double the families we thought per bag of seed sold. We also learned that while surpassing our goals for extra zinc, our last batch of seed didn't meet goals for protein quality. We launched a thorough analysis to find where our parental seed may have been contaminated while simultaneously growing new parental seed for our next production cycle.

Collaborations: Our partner farmer cooperatives largely met production goals, but lagged on sales goals. Several of them have already expressed interest in wanting to continue for next year, but truly making our pitch to seed companies attractive will require better seeds, making our R&D program even more important.

Development: We made Mulago's portfolio and won a $100k grant from ExpoLive. We also have one major challenge: nearly half of our funding is from the US government, and most of that funding is becoming unavailable or ending due to President Trump's decision to cut all aid to Guatemala, Honduras and El Salvador.

SEED PRODUCTION

Seed production efforts were successful with a new area in Eastern Guatemala demonstrating higher yields and increasing the profit margin of Fortaleza F3 production. Semilla Nueva planted 17 of its 24.5 total planned production hectares of Fortaleza F3 during the normal seed production season, leaving additional production for the second half of the year pending sales progress. Semilla Nueva also successfully produced a small pilot of an experimental seed, Fortaleza F17, in the Southern Coast of Guatemala.

Seed production parcels were planted from September through December 2018 and harvested between late-February through early-May. In order to meet much higher production goals than 2017-2018 and to explore potentially higher yields, Semilla Nueva's production team launched production parcels in the eastern Guatemalan department of Chiquimula. The new region is farther from our processing plant, increasing transportation costs, but also has little commercial seed production and farmers with few other industrial production opportunities. Contracted farmers in the region were far more dedicated to the production process than those we have worked with in other regions, and also worked more as a group. Combined with slightly better climatic conditions, higher yields led to 12% lower production costs than our previous seed production record in the previous season. Production in Jutiapa faced challenges, largely due to poor performance of one of the two farmers—and thus failed to show the same decrease in production cost.

In total, seven farmers were contracted to produce seed, six located in the eastern region (two in Jutiapa and four in Chiquimula) and one in the Southern Coast of Guatemala. Total production was 3,054 bags of Fortaleza F3 and 684 bags of Fortaleza F17. 100% of the seed production was supervised by the Guatemalan governmental and all the bags are being sold with an official label. Expenses, estimated revenue, and gross margin for each hybrid can be seen in the table below:

Table 1: Historic and Current Fortaleza F3 Production Costs

Fortaleza F3 (costs per bag, $)	2017-2018 main	2018 off-season	2018-9 main season, Jutiapa	2018-2019 main season, Chiquimula
Seed Production Contracts	26.97	25.38	25.89	23.14
Processing Fees & Seed Treatment	5.16	3.13	3.46	3.09
Field to Processing Site Transportation	3.03	1.96	0.96	0.89
Bags, Labels & Quality Control Tests	2.76	2.36	1.90	1.89
Total Expenses	37.92	32.83	32.22	29.01
Revenue (Expected)	34.72	34.72	34.72	34.72
Gross Margin (Expected)	-3.19	1.89	2.50	5.71
Bags Produced	907	700	511	2543

The production team also successfully produced our first commercial pilot plot of Fortaleza F17. As seen below, its higher sales price will also enable better margin for Semilla Nueva. Seed produced will be used for experimental parcels and small pilot sales in select regions during 2019 and 2020.

Table 2: Production Costs Fortaleza F17

Fortaleza F17 (costs per bag, $)	2018-9 main season
Seed production contracts	24.45
Processing fees & seed treatment	3.25
Field to processing site transportation	0.81
Bags, labels & quality control tests	3.42
Total expenses	31.94
Revenue (expected)	91.67
Gross margin (expected)	59.73
Bags produced	684

In late 2018, Semilla Nueva had to make a difficult decision: should we use funding to re-hire a marketing coordinator or prioritize funding to hire an additional high-level, seed production coordinator for the additional production of the coming season? We prioritized production due to the following advice from our director of operations, "losing marketing may mean you sell less the following year. But in 2019 we are more than tripling our seed production. Failed quality control is the number one reason seed companies fail—even when they have funding and great seeds. If your seeds don't germinate—you'll need to start your seed enterprise from scratch." We heeded the advice, hiring an industry veteran and splitting our seed production and research programs. The result of this prioritization has been the continued trend of lower seed production costs, shown in the table above, due to a combination of better managerial systems, better selection of contracted farmers, more farmer visits, and use of previous industry knowledge in selection of partner farmers and areas. Semilla Nueva's quality control for Fortaleza F3 has remained excellent, with 0 farmer calls due to seed quality, 97% vigor five days after planting, and 98% germination rates eight days after planting—higher than any seed on the market that we have tested.

MARKETING

With Semilla Nueva's expansion to three new regions in 2019, new surveys of agrodealers were launched to both study the new market and verify our understanding of our existing markets. New regions are shown below, including (1) Huehuetenango and Quiche located in the Western Highlands, (2) the Northern Transversal Strip, and (3) Northeastern Guatemala, including the departments of Chiquimula, Zacapa, and Izabal.

Figure 1: New regions: Western Highlands (left), Northern Transversal Strip (center), and Northeastern Guatemala (right)

Figure 2: Map Source (*https://es.wikipedia.org/wiki/Organizacion_territorial_de_Guatemala)*

Information obtained through interviews and electronic surveys with the 22 most important agrodealers in these regions (7 in the Highlands, 5 in the Northern Transversal Strip, and 10 in Northeastern Guatemala). Interviewees confirmed sales of 10,000 bags of hybrid maize seed during the 2018 season. Although no seed was observed in the agrodealers at the time of the visits, agrodealers confirmed that they sold a wide range of hybrid maize brands and variety of prices. After the visits, sales team members then contacted the respective Semilla Nueva distributor to offer Fortaleza seed.

Building on these efforts, Semilla Nueva launched a second survey to verify our 2018 market evaluation. Eighty-three agrodealers were interviewed to determine which seeds were offered, estimates of sales volumes, and prices. This research included agrodealers on the South Coast (53%), Eastern Guatemala (18%), Western Highlands (13%), and Northern Guatemala (16%) regions (map below). Numbers represent agrodealers surveyed.

Figure 3: Distribution of Agrodealers Surveyed

Information per brand and hybrid is recorded in the table below. Twelve different seed brands were reported (four transnational seed companies and eight local seed companies). Of the 12 hybrids sold, one is yellow and the rest white. Five of the eight national brands only offered the same hybrid, HB-83. The most named seed brand was DeKalb (Dk390), follow by Valle Verde (JC-24), and Pioneer (P3966). Hybrid maize is sold to agrodealers in units of bags. Depending on the brand, bags either contain 60 thousand kernels with a weight ranging from 15 to 22 kg per bag, or they weigh 20 kg without an exact kernel number. Small farmers usually buy seed from the agrodealer by pound, while large farmers buy seed from agrodealers by complete bags. The highest seed prices were for seed from transnationals (DeKalb, Pioneer, and Syngenta) with prices ranging from $127 to $175 per bag of 60 thousand kernels. The lowest value was reported for HB-83, with an average price among the five national seed companies of $51 per bag of 20 kg.

Overall this information lines up strongly with our previous 2017 and 2018 market analysis. Semilla Nueva's seed, Fortaleza F3, is included in the table as a reference.

Table 3: Agrodealer Survey 2019 Results

Seed Brand	Hybrid	Number of Agrodealers offering the hybrid	Average price (USD per bag)	Presentation
High Segment				
Dekalb (Monsanto)	DK 447	10	175	Bag of 60k seeds
Dekalb (Monsanto)	DK410	23	163	Bag of 60k seeds
Dekalb (Monsanto)	DK390	59	165	Bag of 60k seeds
Dekalb (Monsanto)	DK7088 (yellow)	7	155	Bag of 60k seeds
Pioneer	P4082	25	173	Bag of 60k seeds
Pioneer	P3966	33	158	Bag of 60k seeds
Syngenta	Sorento	5	127	Bag of 60k seeds
Syngenta	SYM 800	7	160	Bag of 70k seeds
Medium Segment				
CB (Monsanto)	HS-5	31	80	Bag of 20kg
CB (Monsanto)	HS-23	18	87	Bag of 20kg
Valle Verde	JC-24	43	78	Bag of 20kg
Valle Verde	JC-25	3	78	Bag of 20kg
Semillas Futura	HR-245	3	88	Bag of 20kg
Semillas del Tropico	Tropical Max	4	93	Bag of 20kg
Low Segment				
Costa Sur	HB-83	22	53	Bag of 20kg
Costa Sur	Nueva Era 2013	3	65	Bag of 20kg
Super Semillas	HB-83	1	55	Bag of 20kg
Semillas Zacapa	HB-83	5	47	Bag of 20kg
Semillas Bonanza	HB-83	15	49	Bag of 20kg
SN Reference				
Fortaleza	F3		60	Bag of 60k seeds

SALES

Summary:

- As of June 30th, we have sold 1,721 bags of our F3 seed and are on track to meet our original goal of 2,500 total bags to be sold in 2019. However, we will not meet the elevated goal established in late 2018 to sell 4,000 bags.
- Expansion to new areas and farmer retention in Eastern Guatemala were successful, while client retention in the Southern Coast and Northern Guatemala faced challenges due to the price penalties suffered by farmers the previous year due to the small grain size and darker color of protein biofortified grain
- Sales in the Southern Coast and Northern Guatemala were also challenged by poor customer targeting and a mediocre performance by our two regional distributors.
- Semilla Nueva's original five year sales goals are more realistic, at least until we launch new seeds. In the meantime, success will require changes in geographical focus, sales leadership, potentially a launch of a different kind of a high zinc, but not high protein quality seed in certain markets.

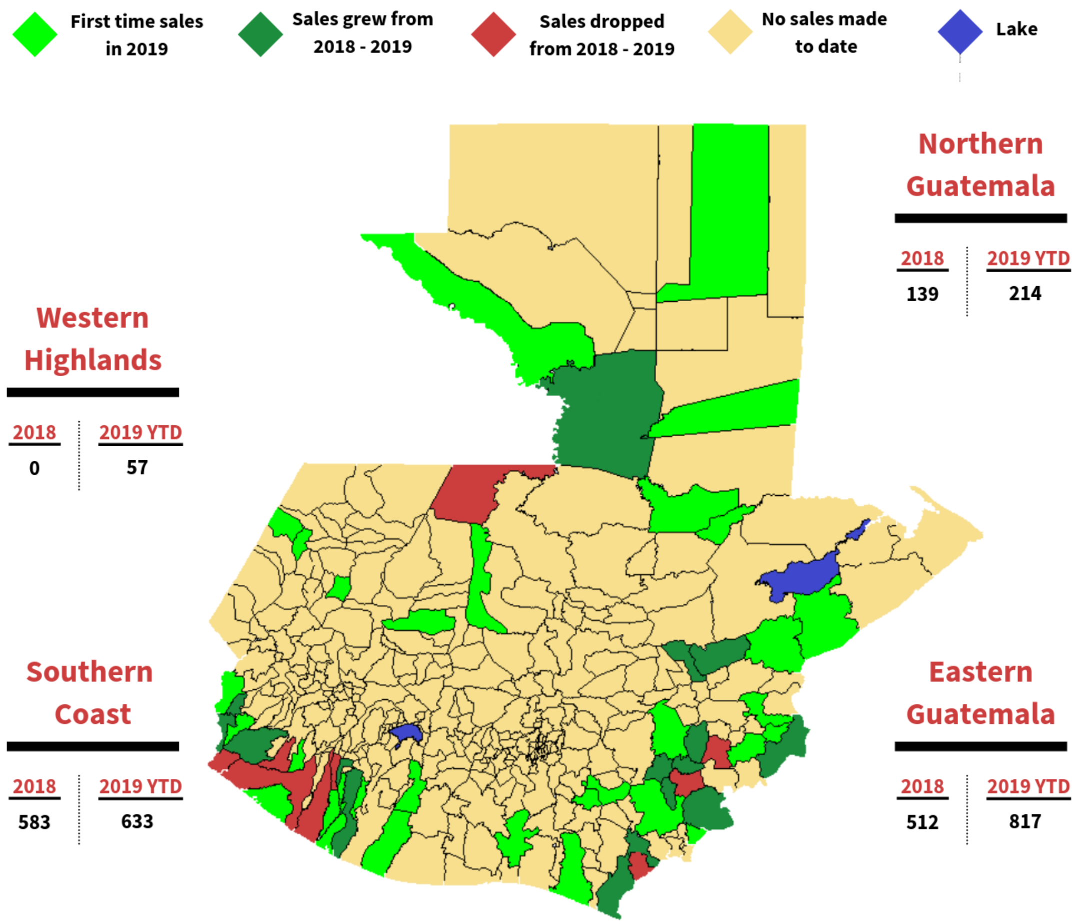
Table 4: Fortaleza F3 Seed Sold, by Region

	2017	2018	2019		
	Total	Total	Jan - June	Sales increase (2018 vs. 2019 YTD)	Number of sales technicians
Southern Coast	34	583	633	8.5%	3
East		512	817	60%	1
North	3	139	214	53%	1
Highlands			57	NA	1
Total	37	1234	1721	39%	

2019 is Semilla Nueva's second year of sales. While many farmers may buy seed after a launch to try it out, the second year shows farmer retention rates and allows a better read of farmer adoption and commercial potential. Overall, we proved that Semilla Nueva's model works, sales grew, and there is potential for additional growth. However, there are also significant challenges which will require adjustments to Semilla Nueva's strategy in certain areas. This report will evaluate sales in each region, before drawing major lessons on the strengths and weaknesses of Semilla Nueva's current product and sales strategy, and then finally summarize our focuses for the following year. It is very important to note that sales are reported through June 2019, meaning this report only shows our initial perspective and potential responses—and more investigation will be done over the coming months.

To provide context for this report, it is also important to understand the main activities of the sales team. They expanded from 58 agrodealers in 2018 to 123 in 2019 to date. They established 42 demonstration parcels and led 58 events involving 1,451 people —including 37 field days, 8 farmer meetings, 12 agrodealer trainings, and 1 tortilleria event. The team also launched radio spots, Fortaleza F3 brochures, and a testimonial video (about Fortaleza F3 tolerance to the 2018 drought).

2018 vs 2019 Year to Date Sales Comparison by Municipality



Eastern Guatemala: As shown by the map above, farmer retention and expansion of sales was high in Eastern Guatemala, which will become the core market for Fortaleza F3. Overall the seed met farmers' expectations. Yields were higher than competitively prices seeds. Benefits of the seed, such as drought tolerance and resistance to lodging (blowing over in strong winds) were evident. Intermediaries didn't penalize farmers for the smaller and slightly darker grain produced by F3 (which is typical of protein biofortified maize). With some small regional exceptions (highlighted in the above map in red), our initial farmer interviews show that the majority of farmers who purchased in 2018 returned to purchase in 2019—and more farmers purchased as well. Initial agrodealer interviews and sales team reports indicated that these gains in sales took place in a difficult year, when higher grain prices may have led farmers to invest in high-segment seed, and a contraction in the overall low and mid-segment market due to competition from subsidized seed from El Salvador, which was smuggled into the country and sold at deeply discounted prices

Southern Coast: In 2018, farmers in several regions of the Southern Coast faced strong penalties when selling grain to intermediaries, despite campaigns to show farmers how to sell their grain and education efforts with intermediaries. Not all farmers received penalties, but multiple interviews have shown that a majority did, with penalties of typically 4-5% ($0.67 on average compared to a selling price of $12-17.33 per 100lb sack of maize). Farmers who used irrigation and sold before or after the main growing season (when intermediaries can maximize pressure on farmers) were not affected, and many repurchased F3 in 2019. In contrast, for farmers who primarily grow in the main rainfed season, the product developed a strong reputation as having a great seed price, an adequate yield, but being bad for grain sales. As a result, many farmers didn't repurchase and discouraged others from doing so.

Our team also uncovered an interesting phenomenon. Acclaim for the better taste and texture of tortillas produced with F3 was nearly universal, with farmers expressing that it was the best maize they'd eaten in decades. Many farmers who had suffered negative experiences with sales purchased only enough seed to produce their maize for home consumption for the year, while purchasing another seed for their commercial maize sales. Other farmers interviewed expressed that they wished they had done so, as they had run out of F3 grain and had to buy worse tasting maize in the local markets.

Our sales technicians in the Southern Coast also largely targeted the wrong customers. Semilla Nueva began asking farmers who attended field days in 2019 the previous seed that they planted. In the Southern coast, high segment farmers (who can afford higher-yielding seed) made up the majority of the farmers who ran demonstration parcels, and an average of 73% of field day attendees previously planted a high-segment seed. In comparison, only 18% of our sales were made to high-segment farmers (see *Impact Evaluation*, below). Sales were also lost due to mediocre performance of our distributor. The distributor's sales team lagged in bringing seed to agrodealers, and our staff traveled to the distributor's warehouse to bring purchased seed to agrodealers themselves on multiple occasions. Further credit issues between several agrodealers and the distributor led to seed not being stocked on time. Both farmer targeting and distributor performance can be improved, offering us opportunities for better sales in 2020.

Still, there is a major achievement to be noted. Sales increased overall in the Southern Coast, while sales of other low and mid-segment seeds decreased, in some cases dramatically. Higher grain prices and positive weather forecasts are cited by agrodealers, farmers, and our distributor as having led farmers to take higher loans and invest in high-segment seed, shrinking the market for low and mid-segment seed. Our distributor's low segment seed dropped in sales from 2,000 bags to 1,200 bags, and 8 surveyed agrodealers all noted that sales for all low-segment and mid-segment seeds were dramatically decreased this year. F3 was the only seed noted by the distributor in the low and mid-segment to increase marketshare during this time.

Peten/Northern Transversal Strip: Peten and the Northern Transversal Strip largely suffered the same problems as the Southern Coast with an important additional problem. Being Guatemala's most remote region and the most recently settled, rule of law and commercial trust in Peten and the Northern Transversal Strip are very weak. Farmers are notoriously bad at repayment, and there are few agrodealers who have an honest enough reputation to be trusted by our distributor. Farmers who asked for seed from agrodealers were asked to wait up to a week for it to be sent from the distributor's warehouse, and were seldom willing to wait that long. Overall, sales in the region did increase from 139 bags in 2018, to 214 bags in 2019 to date, and small niche markets were found where intermediaries didn't cause problems. Nevertheless, the long-term distribution challenges and unique nature of the region may make it a lower priority until new solutions are developed.

Western Highlands: Despite a late start to the project, due to difficulties in negotiating an environmental management plan which would meet USAID standards and yet allow commercial maize production, sales in the Guatemalan highlands exceeded project goals in the five targeted municipalities. Semilla Nueva is cautiously optimistic that sales will continue to meet project goals, showing that in municipalities with the country's highest level of malnutrition, large indigenous populations, and the majority of farmers using native seeds, the model can work.

Photo: in the Sourthern Coast and Northern Guatemala, the taste of protein biofortified maize (QPM) was very well received, but intermediaries penalized the size and color of the grain

Lessons and potential actions:

1) **Focus on Eastern Guatemala**: Semilla Nueva's marketing, sales, and product work well in Eastern Guatemala. Semilla Nueva's original sales goals for 2020 and 2021 have a high likelihood of being achieved by shifting focus and staffing to eastern Guatemala, with reduced goals in other areas.

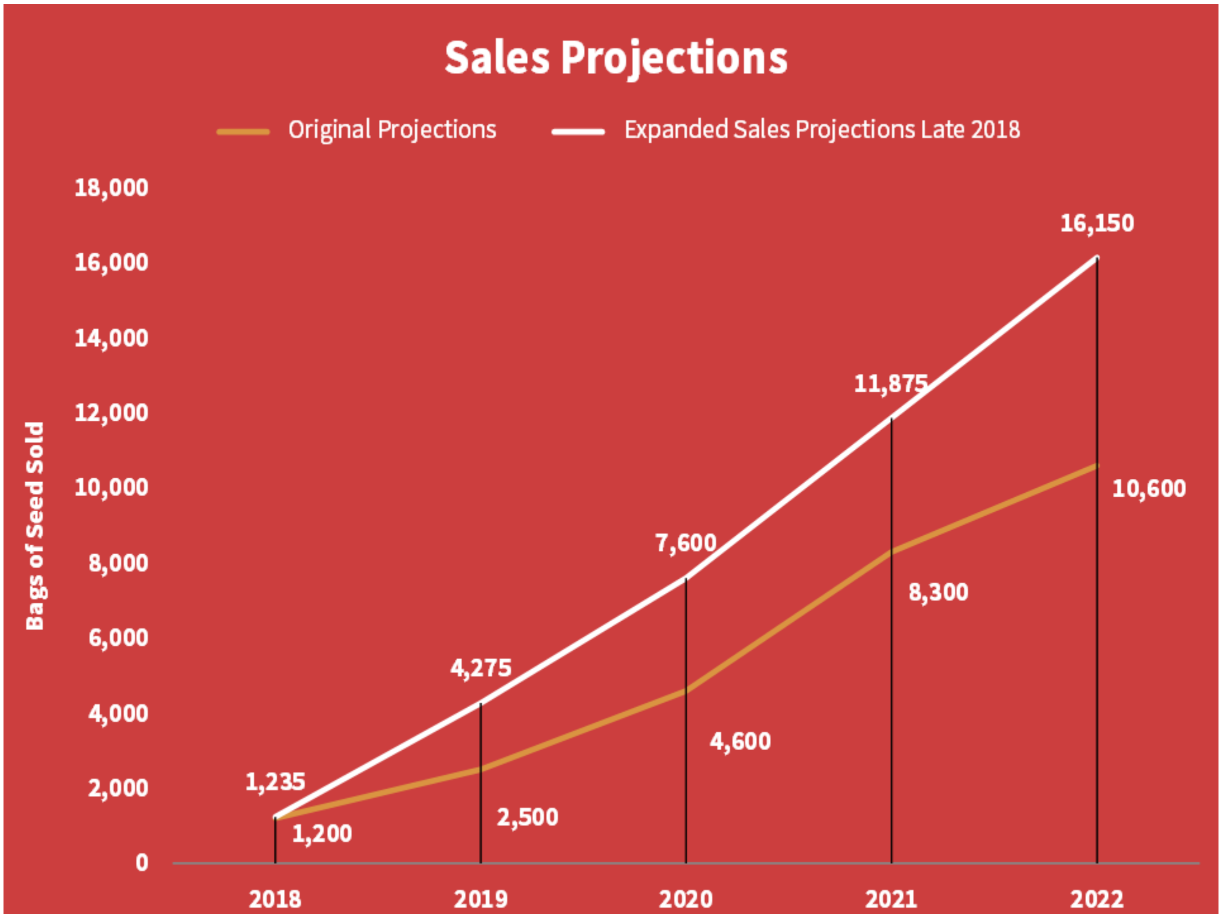
2) **Pilot a new model in areas with grain penalties**: First, sales technicians will focus F3 sales on now-identified, geographical niches within their regions where the market doesn't penalize F3 grain. For example, farmers who grow tobacco in the southern coast typically plant mid-

segment seeds with irrigation before the main season, allowing them to sell grain at a time when it is scarce, and intermediaries don't penalize grain. But since these niches are small, Semilla Nueva is also considering piloting a new marketing strategy with higher potential adoption. Semilla Nueva sales technicians can experiment with marketing F3 as the best seed for home consumption, given its already recognized superior taste and texture. Sales technicians could then also sell a seed with only higher zinc levels (such as F17) to farmers to use for commercial purposes. High zinc (but not high protein quality) seeds to date have shown excellent color and grain size. Further, their higher yields would allow or Semilla Nueva to sell them at a higher price and cover more costs. This blended model may allow Semilla Nueva to maximize nutritional consumption for families, establish a sense of premium nature around the F3 grain (potentially changing intermediary penalties), while still offering a more nutritious product than conventional maize for farmers to sell to local markets. This could provide an intermediate solution while Semilla Nueva's breeding efforts seek higher yields and improved grain appearance among protein biofortified maize varieties.

3) **Improve execution**: While systems were established to improve farmer targeting for Semilla Nueva's field days, demonstration parcels and general sales outreach, there was insufficient compliance. Semilla Nueva will make personnel changes and simplify systems for planning and verification of correct farmer targeting. Negotiations will need to lead distributors to improve the lag time in delivering seed to agrodealers.

4) **Focus on R&D**: Semilla Nueva will need to focus additional resources into seed development, both for more quickly testing new seeds from CIMMYT, as well as in-house breeding. Innovative solutions such as agronomic biofortification (see *Research and Development*) may allow for new products which further increase the financial proposition to small farmers and the nutritional impact on rural families.

While being cautiously optimistic about the results of our second year of sales, it is fair to revert to the original sales projections we made in 2017-2018. New seeds and strategies may allow us to increase them again. Semilla Nueva is highly focused on areas of potential weakness in our model, but it is also important to note that we are on track to double our sales from 2018 to 2019, and even with our original sales projections, we are on track to become the third or fourth largest seller of maize seed in Guatemala within the next five years.


Sales Projections
Original Projections
Expanded Sales Projections Late 2018
Bags of Seed Sold
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
16,150
11,875
10,600
7,600
8,300
4,275
4,600
1,235
2,500
1,200
2018
2019
2020
2021
2022

RESEARCH AND DEVELOPMENT

Summary

- **Memorandum of Understanding (MOU) with CIMMYT**: Semilla Nueva signed an agreement with our research partner, CIMMYT, allowing faster access to new experimental biofortified as well as high-yielding, non-biofortified seeds.
- **New seed evaluation**: five new biofortified seeds are being evaluated in three sites throughout Guatemala. An already licensed new hybrid is being tested for seed producibility and yield with farmers, with potential to launch in 2020 and sales in 2021.
- **Backcross breeding**: Semilla Nueva began evaluating new high-yielding, non-biofortified seeds throughout Guatemala, while simultaneously beginning the breeding process to convert these seeds to have both high protein quality and high zinc. Successfully backcrossed seeds could be launched in 2023-2024, and could have yields 15-25% higher than the best biofortified seeds to date. Semilla Nueva hired a consultant to determine where to locate a new amino acid lab and began negotiation an MOU with the US Department of Agriculture (USDA) to provide technical assistance on lab technologies.
- **Agronomic biofortification and aflatoxin biological control:** Semilla Nueva has continued conversations with international experts in both fields, with agronomic biofortification trials launching in July and October 2019, and conversations with experts on new aflatoxin reduction technologies underway.

Semilla Nueva's current seeds have limitations, as described in the sales section above. Our long-term success in Guatemala and other countries will be dependent on some combination of: 1) improving how quickly and efficiently we bring to trial new seeds from our research partner, CIMMYT (and the quality of their future research), 2) developing our own programs to inexpensively create higher yielding and more acceptable biofortified seeds, and 3) exploring complimentary technologies which can further our health impact using our existing seed sales model.

To date, Semilla Nueva's R&D efforts have been difficult to fund due to a lack of donor interest and the need to prioritize use of our limited unrestricted funds to prove the immediate and core elements of our model. Over the first half of 2019, Semilla Nueva made several key advances which required little additional funding, before reinitiating our breeding program in June 2019 thanks to an infusion of capital from the Mulago Foundation.

An MOU with CIMMYT was signed in early 2019, which allows Semilla Nueva to access the parental lines behind new experimental seeds before those seeds are made public, as well as gain early access to new seeds for trials. This arrangement will allow Semilla Nueva to save 1-4 years between CIMMYT's first trials and a commercial launch in Guatemala, as is shown below:

Table 5: Seed Validation Process with or without CIMMYT MOU

Year	Process without MOU	Process with MOU
1	CIMMYT Trials seed in Mexico	CIMMYT Trials seed in Mexico
2	First trial in Guatemala with SN	First trial in Guatemala with SN
3	Second Trial in Guatemala with SN	CIMMYT sends hybrid seed for SN to trial in Guatemala with farmers

		and lines for evaluation
4	CIMMYT sends seed for SN to trial with farmers	Evaluation with farmers year 2; SN evaluates seed producibility; SN solicits license
5	Test with farmers year 2; SN solicits license	Initial commercial launch
6	CIMMYT sends lines; SN reproduces lines	Full commercial launch
7	SN evaluates seed producibility	
8	SN makes initial commercial launch	
9	Full commercial launch	

CIMMYT sent five new biofortified hybrids after signing the MOU. Semilla Nueva immediately began evaluations (placing these seeds in year 3 of the accelerated pipeline, allowing a commercial launch between 2021-2022. Semilla Nueva began trials of these seeds in seven locations throughout Guatemala in May 2019. Semilla Nueva also continued evaluating a new seed, coded 111. Semilla Nueva produced enough of the seed to evaluated in ten locations in May 2019 and has 600 pounds of seed for evaluations and trials with farmers during the off season. Pending results, Semilla Nueva may launch a pilot production of 111 in Nov 2019 – March 2020, allowing for enough seed to be produced for an initial launch in May 2020, and full commercial sales in 2021.

Secondly, with the MOU, Semilla Nueva launched its new backcross breeding program. There is currently a 10-20% yield gap between the best non-biofortified seeds that local seed companies can access from CIMMYT, and the best biofortified seeds. In March 2019, CIMMYT and Semilla Nueva jointly identified the best new conventional seeds that are under investigation currently. CIMMYT sent Semilla Nueva both these seeds and their parental lines, allowing Semilla Nueva to simultaneously test the seeds before the rest of the industry does, and convert the seeds to biofortified at the same time. Trials began in May 2019, and the conversion process began in June.

This backcross breeding process will require extensive laboratory analysis in June-August 2020, and annually thereafter. This gives us approximately one year to finish a new laboratory using technologies from the USDA and CIMMYT. Semilla Nueva currently has purchased approximately 45% of the necessary lab equipment and is working on fundraising for the remainder. Semilla Nueva also hired a part-time consultant to assist in finishing the laboratory design, determining if the laboratory could be based at Semilla Nueva's office, and assist in technical partnerships. Semilla Nueva also visited the main USDA office in Washington, DC, the main research office in Maryland, and the Iowa laboratory which has designed the new testing methods that Semilla Nueva will use. A MOU draft was written, reviewed, and is currently being revised by the USDA.

Finally, we are continuing to explore two new technologies which could expand the commercial feasibility of our model and the health impacts provided to rural families. First, in July 2019 we are launching a set of trials to evaluate agronomic biofortification of maize with zinc. Studies have shown that coating seeds with zinc and spraying maize plants with zinc can both increase yield and the zinc levels of the grain later eaten by farm families. Semilla Nueva will test this approach with both biofortified and non-biofortified seeds to determine the increases in zinc content and the cost effectiveness of this model. Semilla Nueva is also working with the USDA to explore tests of a new biological control treatment to decrease aflatoxins in maize. Both technologies could allow an increase in the positive health impact of the seeds Semilla Nueva currently sells.

SEMILLA NUEVA COLLABORATIONS

Background: Semilla Nueva's collaboration program assists other seed companies in producing and selling biofortified seed. It is a part of our overall effort to convert the seed sector in Guatemala to provide more nutritious seed.

Summary

- **Three cooperatives produced and sold nearly 600 bags of biofortified seed this year**: due to Semilla Nueva's efforts, three farmer cooperatives dedicated to commercial seed sales and a small NGO produced and sold biofortified seed in 2019. While seed production largely met our goals, sales to date have been mixed. One cooperative sold all seed produced in May and June 2019, while the other two have sold more than half of their produced seed.
- **Program growth will largely depend on launching more competitive seeds**: The additional costs to produce Fortaleza F3 vs. the current seeds combined with the need for additional marketing and sales make continual sales growth problematic. Two of the three cooperatives are interested in continuing the program, but they consider that additional annual sales volume will require higher yielding biofortified seeds. Seed cooperatives had previously sold seeds with high market recognition where promotion was unnecessary, and found the promotion required to sell a new, largely unknown seed to be difficult.

Figure 4: Field day with ICTA HB-18 at ASOPRAE demo parcel, April, 2019

- **Farmer cooperatives ATESCATEL, APALH, and ASOPRAE:** The successful introduction of ICTA HB-18 (the generic government name for Semilla Nueva's Fortaleza F3) by farmer cooperative ATESCATEL in early 2018 attracted the attention of two additional farmer cooperatives located in eastern Guatemala. During late 2018 and early 2019, all three cooperatives produced ICTA HB-18 with technical assistance, basic seed, and seed bags provided by Semilla Nueva. All but one production parcel was successfully harvested, and yields averaged 2.8 mt/Ha, similar to Semilla Nueva's earlier production yields. After extensive training and follow-up from Semilla Nueva staff, APALH and ATESCATEL both have offered to lead future production efforts without Semilla Nueva oversight. ASOPRAE's region for seed production was not optimal, and it is unclear whether they will attempt to produce ICTA HB-18 again, or if they may ask ATESCATEL or APALH to produce for them.

Seed promotion, however, didn't meet Semilla Nueva's hopes. ATESCATEL, APALH, and ASOPRAE have over 10 years of experience selling seeds which have 15-36 years of time in the market (ICTA B-7 and ICTA HB-83). Since most local farmers know the seed already, demonstration parcels, field days, or other promotional efforts have been unnecessary, and all three cooperatives simply bring seed to agrodealers who sell for them. Promotion for a new seed largely unknown in the market proved challenging to all three organizations, especially given their lack of paid staff to take on promotional duties. ATESCATEL and ASOPRAE each only established a single demonstration plot (compared to 43 established by Semilla Nueva), and only ASOPRAE led a single field day with 20 attendees (compared to Semilla Nueva's 58 events with 1451 people attending). Results are shown below:

Table 6: Production, Sales, Remaining Inventory by Cooperative

Bags (60,000 seeds)	ATESACATEL	APALH	ASOPRAE	Total
ICTA HB-18 production goal	400	400	200	1,000
ICTA HB-18 production achieved	547	317	116	979
ICTA HB-18 sales goal	400	400	200	1,000
ICTA HB-18 sales	198	317	82	597
ICTA HB-18 inventory remaining	347	0	34	381

Over the course of June and July, Semilla Nueva's leadership team held several meetings with the leadership of the farmer cooperatives, arriving at the following conclusions:

- The leadership is interested in selling ICTA HB-18 again in 2020, but sales volume will likely not increase.
- Technical assistance for production is no longer necessary, but assistance in seed promotion and sales will be important and represents an important area of growth.
- There is considerable interest in testing the new biofortified seeds that Semilla Nueva is currently evaluating with CIMMYT. Increased sales will be possible if a seed with lower production costs and/or higher yields becomes available.

Semilla Nueva's collaboration program is designed to pilot strategies to help Guatemala's local seed companies to switch from selling conventional seeds to selling biofortified seeds. The results of our first year of commercial hybrid sales with three organization shows structural issues that we will face with the other dozen seed companies in Guatemala. Our first seed, ICTA HB-18 (F3), has a slightly higher yield than the seeds all three cooperatives sell, but it is slightly more expensive to produce and requires additional marketing and promotion. For these organizations, this represents a somewhat neutral proposition. It isn't bad enough to reject outright, but it also isn't good enough to increase profits sufficiently to justify extensive investment. For Semilla Nueva, this means that: 1) resources, albeit reduced, should be invested to continue assisting the three farmer cooperatives in selling ICTA HB-18, and 2) some resources should be diverted to seed development, since expansion of this collaborative model will become more feasible with seeds that are high enough yielding to justify higher production and marketing costs for small Guatemalan seed companies.

Alcaldia Maya

As mentioned in the previous report, this was our last period of working with the local NGO, Alcaldia Maya. Helping local NGOs with no seed producing experience to produce and market biofortified seeds has proven to be possible, but does not provide a good return on time. Alcaldia Maya did implement three demonstration plots and held two field days, impacting a total of 20 farmers. They also produced 30 bags of seed. To date, sales are only approximately 10% of the produced volume, largely due to a lack of active promotion given the organization's other responsibilities.

IMPACT EVALUATION

Summary

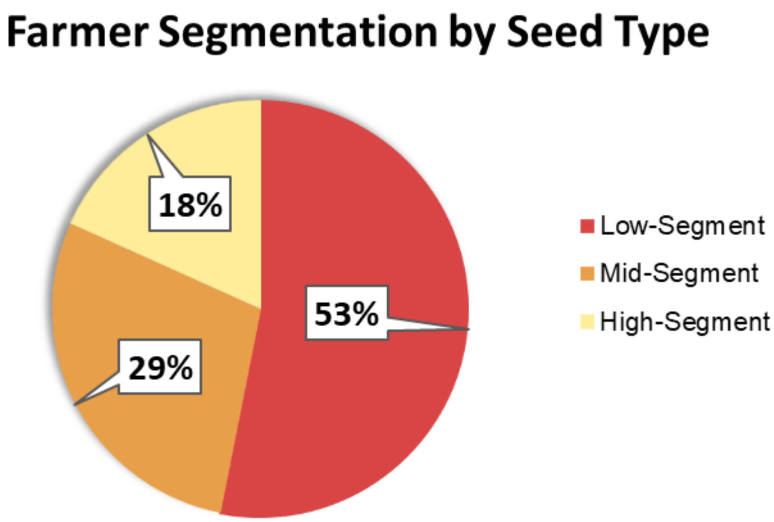
- **More, and poorer, farmers buy our seed than we thought:** Semilla Nueva trialed a new system of interviewing agrodealers to determine the number of families purchasing seed. More development is needed, but initial results showed more families are reached per bag of seed sold than initially estimated and that seed is being purchased by poorer farmers. Improvements in targeting farmers for economic analysis will provide new economic impact estimates for late 2019.
- **Zinc was above estimates, protein quality was below—we're working to fix that**: While the level of zinc in the grain produced by farmers came out higher than anticipated last year, results for protein quality obtained this year were below expectation. Semilla Nueva sent in parental seed for analysis at CIMMYT and is producing new parental seed; working simultaneously to identify the exact source of the problem and fix it for next year's production.
- **Ex-ante model continues progress**: Semilla Nueva is on track for a first version of our model to correlate adoption of biofortified seeds with health outcomes throughout the Guatemalan population by fall 2019. Zinc deficiencies across the Guatemalan population have been modeled. Next steps are predicting which farmers will adopt biofortified seeds in the future, and then calculating decreased zinc and protein quality deficiencies in the population.

How many farmers are buying our seed? What other seed would they have bought? Throughout 2018 we had a major problem estimating our impact. We sell our seed to farmers through agrodealers (small local retailers). Agrodealers are very careful to never share contact information with an input provider like Semilla Nueva out of fear that the provider will begin to sell directly to their clients. As a result, we knew how many bags of seed we sold, but we couldn't reach the farmers who purchased, leaving us unable to determine the following:

1) If farmers hadn't bought Fortaleza F3, what seed would they have purchased? (since we know how F3 yields compared to other seeds, we can use this to estimate impacts on farmer income)
2) How much seed did they farmers buy each? (using this information we can estimate the total number of families we are impacting)

To further complicate matters, while the Semilla Nueva team does meet farmers at field days and in their local communities, our team ends up meeting community leaders and the wealthiest and most active farmers—making them far from a representative sample of our customers.

Semilla Nueva spent 2019 creating two solutions to this monitoring problem. First, are expanding the number of farmers we will survey at the end of the year, hoping to get a more representative sample. Second, we piloted surveys for agrodealers, asking the average amount of seed they sold per farmer, and what those farmers would have bought if they hadn't purchased F3. The initial survey was only done with 18 agrodealers out of the 123 who sold our seed, and an additional survey will be done in late summer 2019. The initial results were surprising. Large numbers of farmers were buying seed by pound, instead of buying complete bags (as mentioned in the sales section of this report). As a result, based on weighted averages, our initial estimate for the number of farmers benefitted per bag of Fortaleza F3 is 2.01, up from our initial conservative estimate in 2018 of 1. The survey also asked agrodealers, many of whom know most of their clients very well, what seed they believe farmers would have purchased if they hadn't purchased F3. Fortaleza F3 was mainly purchased by farmers who normally use low and mid-segment seeds, which is a very positive result given that F3 is most competitive in these segments.



By refining the data summarized above with the more representative farmer yield trials we expect to finish late this year, Semilla Nueva will be able to estimate the total economic impact, on an annual basis, of our program. Combined with additional surveys on family consumption, Semilla Nueva is on track to build a systematized monitoring and evaluation (M&E) system which will track families reached, economic impact, and nutritional impact of our seed on a yearly basis.

Protein quality – our first major quality control issue: In 2016, Semilla Nueva sent five Fortaleza F3 samples to CIMMYT to evaluate amino acids and zinc. Four of five samples showed adequate nutritional levels. In 2017, samples were provided to Harvest Plus, but only zinc was tested due to limited funding. In 2018, thanks to a grant from Light a Single Candle, Semilla Nueva sent in 32 pairs of Fortaleza F3 and commercial controls from farmers' fields to CIMMYT for nutritional analysis. Zinc results were provided in late 2018 and showed zinc levels higher than anticipated for Semilla Nueva's seed vs. commercial controls. Amino acid results weren't returned until February, 2019. Both amino acids were not in the normal ranges for a QPM hybrid. Amino acid lysine was closer to normal Quality Protein Maize (QPM) levels than conventional maize, while tryptophan had levels closer to conventional maize levels than QPM. Both levels were within the range for opaque 2 maize, the mutation which originally led to QPM, as illustrated below:

Table 7: Amino Acid Quality Control Results and Reference 2019

Kind of Maize	Lysine (% of protein)	Tryptophan (% of protein)
Fortaleza 3 results	3.37	0.504
QPM average	4	0.8
Conventional maize average	2	0.4
Opaque 2 maize range	2.7-4.5	0.5-1.1

After extensive discussion, investigation, and reviewing our previous testing data, we determined that the most likely cause of these lower levels of amino acids was genetic contamination within our parental seed. We decided to take a two-pronged strategy. First, CIMMYT had sent new parental lines to Semilla Nueva for another project in 2018 and these were already being multiplied. Semilla Nueva accelerated that process, working to produce fresh and more genetically pure parental seed to be used in our next seed production cycle in 2019-2020. Second, Semilla Nueva sent in samples to CIMMYT for amino acid evaluation of our older parental seed, newer parental seed, and a sample of commercial seed we had been selling. Given the time delay for laboratory testing (2-4 months in total), we simultaneously began to produce fresh parental seed, while searching for the specific parental line which had been contaminated.

Results of this effort will be described in our next standard report, and an additional round of quality control samples of this year's commercial grain will also be sent to CIMMYT for testing. There is an important lesson, however, from this experience.

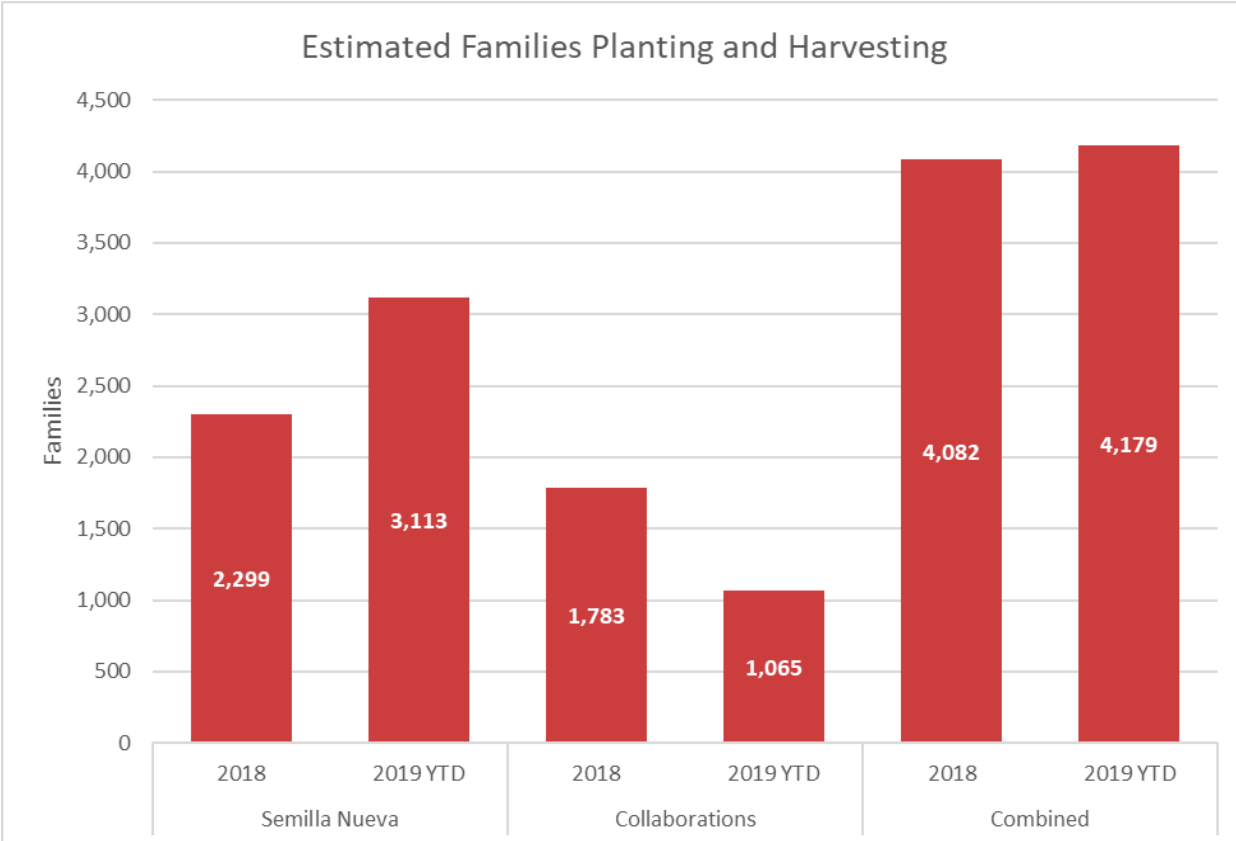
Quality control is difficult for Semilla Nueva for two main reasons. First, there have been major complications in sending samples to CIMMYT for testing. Sending maize grain requires months of paperwork and large additional costs. Sending maize flour requires collaborating with local laboratories for grinding samples without contaminating them. We chose this second route in 2018, and mix-ups at the local laboratory caused additional problems and whole samples had to be discarded. Second, this process takes a long time. Samples were collected in September – October of 2018, but results weren't received until February 2019, meaning no changes could have been made in our 2018-2019 seed production cycle. This is the major reason that Semilla Nueva will prioritize developing a high-throughput, low-cost amino acid lab in Guatemala (as mentioned in the R&D section of this report). With the right equipment and staff, results for hundreds of samples for amino acids will be provided in three days at a material cost of around $0.10 per sample.

Ex-Ante Impact Model

Background: Measuring actual impacts of increased nutrition on health outcomes requires expensive and complex research trials. While nutritional assessments of biofortified crops have largely demonstrated positive health implications of quality protein and zinc, definitive findings, in particular for Guatemala, are still needed. In lieu of a multi-year trial costing $500,000 to $1,500,000, Semilla Nueva has sought a statistically rigorous approach, utilizing the resources at hand. In early 2019, Semilla Nueva developed the first components of an ex-ante nutritional impact model for biofortified maize. These models have already been developed for other biofortified crops in other countries and show the impact that increased adoption of a more nutritious seed should have on the health of farming families and consumers at different levels of hypothetical adoption. They do this by incorporating information on nutritional gaps in the diet for different demographics, the amount of the target crop consumed, the amount produced by farmers, and the level of additional nutrition. By combining information generated from the annual surveys mentioned above with national consumption datasets from the Guatemalan population and models on the health impact of alleviating different levels of protein quality and zinc deficiency, this model will allow a rigorous prediction of the health impact that Semilla Nueva and collaborators can achieve both with current sales levels and at different points based on our sales projections.

Ex-ante update: Semilla Nueva's monitoring and evaluation coordinator has completed the first major component of the model, processing Guatemala's 2006 home consumption and expenditure survey (HCES) to evaluate the Guatemalan diet, maize consumption patterns, and nutritional deficiencies. The 2006 data set includes 13,686 households, broken into 68,739 individuals, representing the entire Guatemalan population. A 2014 HCES dataset is available, but the data isn't usable until the government and partners make nutritional equivalents tables for the foods referenced. Semilla Nueva's M&E coordinator is now working to develop a model for predicting the kind of farmers who will adopt biofortified maize, and then model family consumption, sales, and the consumption of biofortified maize sold in the market. This information will make possible a prediction of nutritional and health impact for biofortified at different levels of market penetration, and later, at different levels of biofortification.

Updated Impact Metrics: Using the methodology for estimates of impact on both direct and indirect beneficiaries mentioned in our Jan 2018 standard report, Semilla Nueva has updated our impact calculations for 2018 and 2019 year-to-date based on sales. These estimates use the new agrodealer survey data mentioned above, assuming 2.01 families were reached per bag sold for both 2019 and 2018, with an additional 10% discount to stay conservative. Our original estimates in 2018 assumed 1 farmer per bag. Additionally, it is important to clarify that our collaborators sell their seed in at a variety of bag weights. Last year bags were, on average, sold in 25 lbs quantities while bags in 2019 have been sold in 30 lbs quantities, on average. This change in bag size is partially responsibe for the decrease in families reached by collaborators. Semilla Nueva continues to sell our seed at 60,000 seeds per bag which, contingent on seed quality, can weigh anywhere from 35 to 39 lbs, on average. Lastly, indirect beneficiaries use an approximate calculation based on the amount of maize our clients are selling to the market. We hope to change this indicator in the coming reports to estimated health impact in the population based on our ex-ante model.


Estimated Families Planting and Harvesting
Families
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,299
3,113
1,783
1,065
4,082
4,179
2018
2019 YTD
2018
2019 YTD
2018
2019 YTD
Semilla Nueva
Collaborations
Combined

DEVELOPMENT

Summary: Over the first 6 months of 2018, two new funding sources were secured from the Mulago Foundation and ExpoLive. Semilla Nueva currently has sufficient cash on hand and commitments to last until February-March of 2020, with a number of major renewals coming up in late 2019. Semilla Nueva also has had one major setback. President Trump's decision to cut all foreign aid to Guatemala terminated the main sources of anticipated funding increases for Semilla Nueva. In addition, one of our signed USAID subcontracts may end early as a result. Semilla Nueva will need to pivot, reposition and search for other donors to deal with these anticipated shortfalls.

Mulago and ExpoLive: Semilla Nueva was selected to join Mulago's Portfolio in May 2019. The portfolio is one of the most competitive and prestigious recognitions for social enterprises and high impact organizations. Continuance in the portfolio is evaluated annually. This funding is especially valuable because it is unrestricted and is already being used to re-launch Semilla Nueva's much needed breeding and seed development program.

Semilla Nueva also won a grant from ExpoLive based on a successful pitch contest made by Executive Director, Curt Bowen, in Dubai in May 2019 and a grant application. ExpoLive is part of the Dubai government's efforts to promote the upcoming 2020 world expo in Dubai. The grant will cover expanded sales efforts during 2020.

The renewal of Miracles in Action's grant to Semilla Nueva was made possible through *Cruising for a Cause*. A program led by Penny Rambacher resulted in over $40,000 of funds raised in one evening for Semilla Nueva's work.

Although this report only covers new and renewed funding for the first half of the year, Semilla Nueva is grateful for all our supporters and partners who have helped create new programs and grow the organization to where it is today.

FINANCE / ADMINISTRATION

Administration:

Semilla Nueva: NGO and the Seed Venture

In response to a combination of Guatemalan legal and international donor requirements, Semilla Nueva launched a for-profit seed company, owned by our US nonprofit. This arrangement allows Semilla Nueva to sell seed in Guatemala with a lower risk of being audited, and also opens additional channels for funding. Referred to as our "seed venture," Semilla Nueva S.A. is now legally registered under Guatemalan law. In February, the seed venture signed its first two-year contract with Fintrac to manage a USAID-funded grant through the Partnering for Innovation program.

The process of integrating and delineating the two organizations is still ongoing. Seed which was produced for the 2019 sales season was done so by our Guatemalan NGO, and thus the NGO sold and will continue to sell this batch of seed to distributors. Future production will be done by the seed venture. Eight team members have been transferred to the seed venture (largely those focused on the Partnering for Innovation project), with more to transition in early 2020. These team members are shown in the organigram on the following page in green.

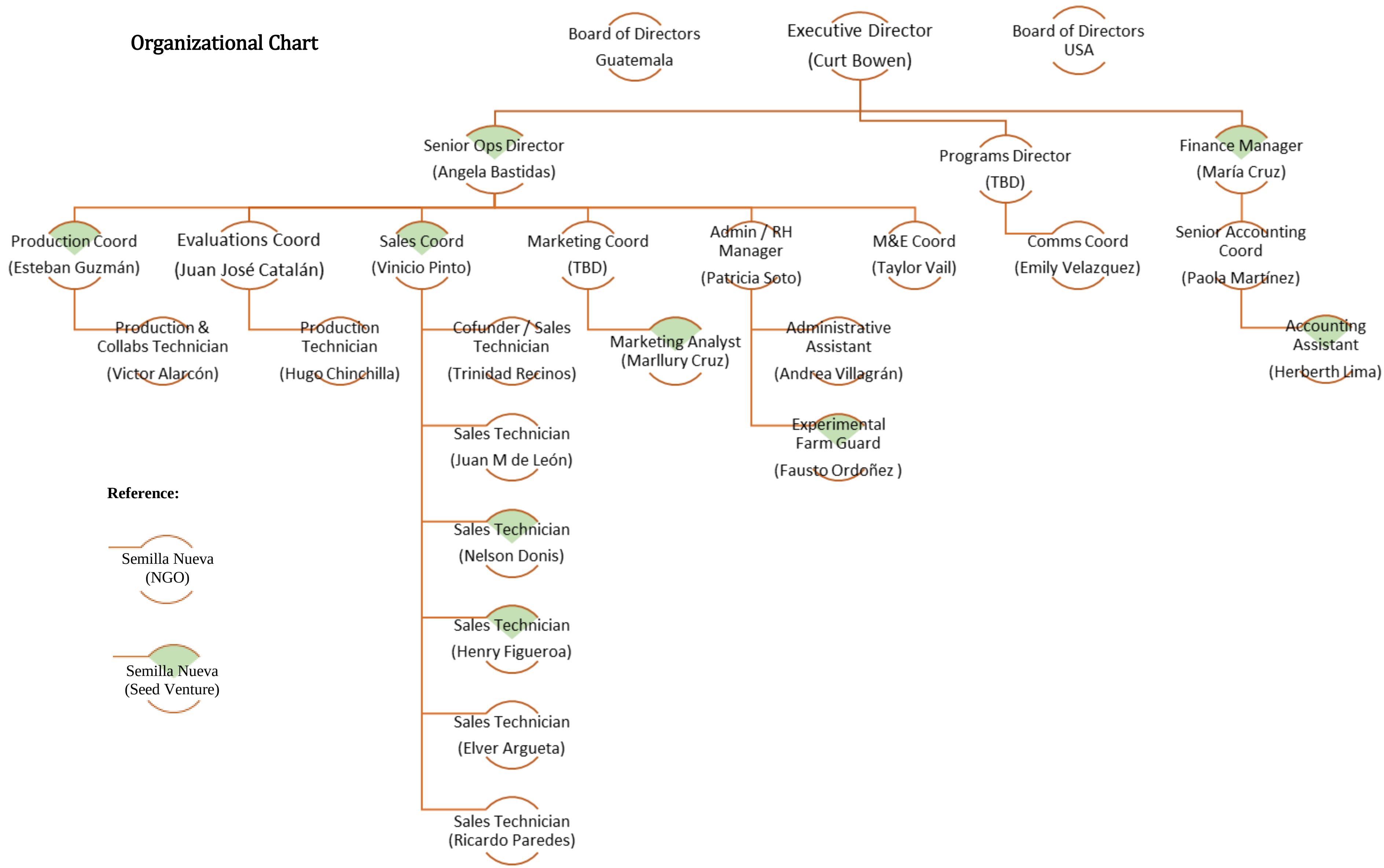
Both Semilla Nueva's two new USAID subcontracts and the logistics of managing three organizations (our US nonprofit, our subsidiary Guatemalan nonprofit, and now a subsidiary Guatemalan company), has created a large increase in office work. Combined with Semilla Nueva's first successful maternity leave taken by our finance and administration manager at the beginning of the year, it was necessary to hire an administrative manager.

The additional staff capacity enabled us to launch our seed venture, implement our tracking systems for USAID, review internal processes, and update contracting, hiring, and performance review systems. Further, a new financial tracking system was launched to track US government funding between the different organizations and ensure accurate utilization of leverage funds. Our goal has been to not just satisfy current requirements but build the infrastructure to prepare for direct contracts with large development organizations like USAID in the future.

Five Year Strategic Plan finally approved!

This April, the Five-Year Strategic Plan was approved by our Board of Directors. The plan was the result of 18 months of work by Semilla Nueva's leadership team and board planning and results committee. The document will be reviewed as necessary and at least biannually.

Organizational Chart

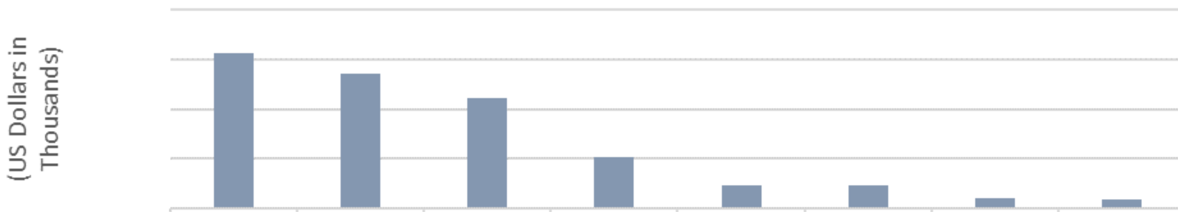


Finance:

Budget Overview

Semilla Nueva's budget for 2019 is $1.04 million, 33% higher than 2018. The increase largely corresponds to increased production staff and more than tripling seed production for 2019.

Figure 5: 2019 Semilla Nueva Budget by Department



	PROD	SALES	ADM	DEV	M&E	COLLABS	MKT	EXP FARM
2019 Budget	312	270	223	103	48	46	22	19

Expenditure by Department: January – June 2019

By the end of June, we had executed 52% of our budget ($553K) out of a planned 56% ($587K) corresponding to the first half of 2019. Planned execution is higher for the first half of the year due to higher seed production costs before the main planting season in April-June. Expenditures in development were slightly higher due to contracting a service to assist with grant writing. Funding in both marketing and collaborations were reprogramed for seed production, given the need for extra personnel and quality control.