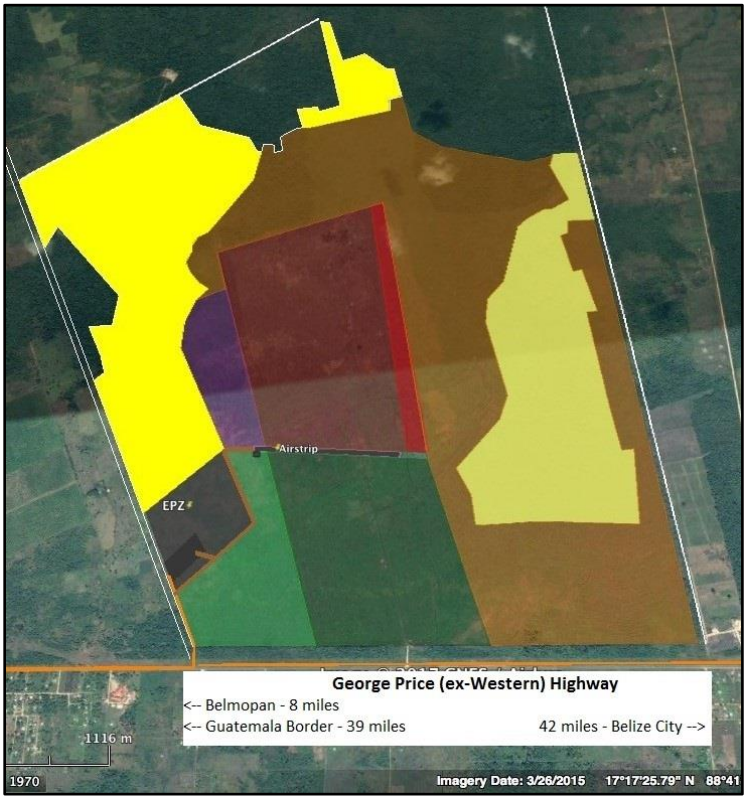
Belize Sustainable Agriculture, Ltd.
Farming Report – October 9th, 2017

This is the **Eighth** Farming Report for BSA's 2017 Summer (Wet) season. Its main objectives are to inform readers about BSA's farming activities by season and crop; to provide data on climactic conditions, agricultural pests, and market conditions; as well as detailed data on BSA's farming methodologies.



Field 2: Subsoiled & Leveled	106 Ha	Mix Plow / Subsoil in progress	270 Ha
Field 2: Leveled / No Subsoil	13 Ha	Windrow / Work in Progress	173 Ha
Field 2N: Plowed / Some subsoil	23 Ha	Chained – No further work	109 Ha
Field 1: Leveled / No Subsoil	79 Ha	EPZ – Total Area	24 Ha
Field 1N: Plowed & Subsoiled	36 Ha	EPZ – Finished	2 Ha

BSA is only farming at the Cayo One Estate in the Summer 2017 season; it is situated some 8 miles east of Belmopan near the village of Cotton Tree in the Cayo District, and is ~39 miles east of the Belize-Guatemala border at Melchor de Mencos.

Weather Summary: September was an atypically dry month, more reminiscent of the "Little Dry" period often seen in August in Belize. Rain returned with a vengeance in October, with the first 9 days experiencing unusually heavy rainfall. Tropical cyclone activity continues unabated, with Hurricane Nate being the most recent storm to come close to Belize. Historical data indicate that tropical cyclone activity should abate by mid-November.

Cayo One - Belmopan Precipitation Data (mm per month) – 2017 Season YTD Data through October 9th													
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
2016/17	295	345	96	55	74	126	10	263	237	210	148	284	
2000-2016	232	129	139	65	49	32	124	271	256	236	230	260	2039

You can follow Belize's weather on: http://www.hydromet.gov.bz/observations/radar/radar-images

We also use the US NOAA Hurricane Center weather radar network which monitors the Caribbean basin, and recommend:
http://www.nhc.noaa.gov/ https://www.wunderground.com/q/zmw:00000.1.WMGMM

Cayo One: ~ 201 Hectares (100% non-irrigated)

The exact acreage to be planted during the Summer 2017 season has now been determined, which is comprised of Fields 1 and 2. Most of Field 2 has been subsoiled, and, as the discussion and photographs below demonstrate, we continue to be well pleased with the early indications of the benefits of subsoiling.

Weather Analysis

September recorded an unusually dry total of 148mm of rain, most of it in the early part of the month. Temperatures remained above average (33C/92F) and very humid (99%).

There was considerable moisture in the soil so the lack of rain during the last three weeks of September was not an issue for the corn crop.

The first part of October saw heavy rains, with some 284mm in just 9 days, including 280mm in the first 5 days. This has returned ground moisture levels to an above average level. Even in the absence of rain through to harvest, which is statistically unlikely, crops would suffer no damage from lack of rain.

We are now coming off the peak of what has been a very active Tropical Cyclone season, with another 4-6 weeks during which further cyclone activity might occur. After Harvey and Irma's devastating impact on Texas and Florida, Maria wreaked havoc on Puerto Rico. Then came Nate, forming unexpectedly in the western Caribbean, with a potential to clip Belize on its way north. Fortunately for Belize, Nate skirted the Yucatan before making landfall on the US Gulf Coast.

With the hurricane season approaching its end we look to long term statistical data for some comfort about our crop's exposure to cyclone damage, recognizing that it is in the month before harvest, when ears are developed and the corn plant weaker, that the crop damage risk from storms with high winds is greatest.

However, as we have written before, predicting Tropical Cyclone activity and landfalls is extremely difficult and we continue to rely on long term (100+ year) data that indicate that a tropical cyclone is not likely to impact Cayo One more than once a decade.

Land Preparation

There are two components to CSA's Land Preparation activities in 2017: Land Development and Farmland Preparation.

Land Development

A detailed discussion of CSA's Land Development activities was provided in the June 19th, 2017 Farming Report, which is available upon request.

As of October 9th, 2017 the status of BSA's fields is:

Field 1 (79 Ha): was planted July 17th – 18th
Field 2 (122 Ha): was planted July 15th – 17th

We hope to have an interesting ability to compare the impact of subsoiling, as a small section of Field 2 (13 Ha) was not subsoiled, and Field 1 was not subsoiled.

Seed Selection, Planting, and Crop Development

Seed Selection

Acreages planted so far are:

- Syngenta Impacto® – 197 Ha / 482 acres (Field 2 and most of Field 1) @ ~70,000 seeds/Ha or ~28,340 seeds/acre
- Pioneer® 4226 – 4 Ha / 10 acres (a small part of Field 1) @ ~70,000 seeds/Ha or ~28,340 seeds/acre

A detailed discussion of these two non-GMO hybrids is in the June 19th, 2017 Farming Report, which is available upon request.

Both plant varieties continue to develop well, but our recent field survey has identified some noticeable differences in ear development.

Impacto® has shown very satisfactory plant growth all the way through the commencement of reproduction, with little evidence of disease or plant issues. As discussed below, all of the Cayo One corn suffered from the high afternoon temperatures during the pollination phase, leading to the upper section of most ears not filling properly. Impacto® ears achieved an average 425 kernel count versus a goal of 550/575. What is noteworthy, however, is the number of viable ears which formed. With a plant count per Ha/Acre of 69,640/28,200, our Impacto® field survey recorded 74,737/30,258 viable ears. This means that Impacto® saw a 107% viable ear/plant ratio. We did not include in our ear count an additional large number of underdeveloped ears which may yield small amounts (20-50) of viable kernels.

The remaining variable to be able to estimate yield is kernel size/weight. Impacto® typically has larger kernels than the DeKalb® 7088 planted at Cayo One in previous years. The latter's kernel size would average 394-413/100gm (100,000-105,000/Bu). We would expect Impacto® to average 374-394/100gm (95,000-100,000/Bu). However, this is a variable that is too early to estimate…

Pioneer® 4226 continued to "catch up" on its growth lag versus Impacto® and we still find it to be somewhat more disease prone than Impacto®. 4226 had the same pollination issues as Impacto®, with the upper portion of the ears not pollinating properly. 4226 ears achieved an average 400 kernel count versus a goal of 500/525. 4226 is a variety known for lower kernel counts but substantially larger kernel sizes. Ear count did not reach the absolute levels of the Impacto® variety, with an ear count per Ha/Acre of 69,424/28,107 versus a plant count of 65,920/26,690 viable ears, which nonetheless represented a 105% viable ear/plant ratio.

The key remaining issue to determine yields for both varieties will be kernel size/weight, which we would be able to estimate shortly before harvest.

Planting Analytics

Planting Analytics were generally very encouraging, and the data obtained from our Seed Sense FieldView™ software has been very edifying. Singulation, spacing, and ride were all at >99%, and compaction very slight, averaging <2%. The information gleaned will help us further improve our planting next season.

A detailed report on Planting Analytics, with excerpts of computer printouts from our Seed Sense planting software, was provided in the July 17th Farming Report which is available upon request.

Crop Development

As of October 9th, the corn crop is at various points in the R5 "Dent" phase. Most of Field 2 appears at the end of this phase and Field 1 is entering it.

R5 occurs about 36 days after silking. Nearly all kernels are dented or denting. Drying kernels show a small, hard, white layer on top. A white line (known as the milk line or starch line) can be seen across the kernel shortly after denting (starch line indicates maturity; it will advance toward the kernel tip with maturity).

Stress at this point can reduce kernel weight but not kernel number. A hard frost (not a problem in Belize!) can stop dry-matter accumulation and cause a premature black layer formation. Kernels at this stage have about 55 percent moisture. At around 48 days after silking, all the kernels should be fully dented. The seed embryo is morphologically mature. Dry-matter accumulation in the kernels will cease soon.

The afternoon heat we experienced in early September during pollination, noted in our previous report, appears to have had more of an impact than we originally anticipated. While all of the ~300 ears we surveyed pollinated, the upper 20-25% did not pollinate properly, leading to a reduction in kernel count.

At this stage of the crop, the only remaining variable is the size/weight of kernels. There has been no shortage of water, and our nutrition program has been more than generous. Accordingly, we expect kernel size to reach the typical range for the Impacto® variety, which averages 374-394/100gm (95,000-100,000/Bu). Impacto® represents over 95% of the 2017 corn crop.

Field Survey Results

On September 26, 2017 a follow-up field survey was performed in which the previously surveyed sixteen random, geo-mapped sections were re-surveyed for a "viable ear" count. Each section containing 16 segments that each measured approximately 1/1000th of an acre [17'6"], so in total we counted the ears on well over 7,000 corn plants!

The results of the survey were:

- Impacto®: Pollination was affected by afternoon heat, leading to 20-25% kernel loss. This is partially offset by excellent results on viable ear formation.

- Pioneer® 4226: Pollination was also affected by afternoon heat, leading to 20-25% kernel loss. This will also be partially offset, although less so than with Impacto®, by very good results on viable ear formation.

September 26, 2017 Field Survey	Plant Count		Viable Ear Count		Kernels per Ear
	Ha	Acre	Ha	Acre	
Impacto®	69,640	28,200	74,737	30,258	425
Pioneer® 4226	65,920	26,690	69,424	28,107	401

The next key data point prior to harvest will be a preliminary indication on kernel size/weight. We expect to perform a survey in the final week of October.

Fertilizer Program

BSA has set a goal of a minimum average yield of 7 mt/Ha (112 bushels/acre) for its Summer 2017 corn crop.

However, CSA is fertilizing for a 9.4 mt/Ha (150 bushel/acre) yield, assuming a minimum fertilization rate of 110% of maintenance levels (the level at which the crop neither adds nor depletes to the soil's fertility).

We continue to leverage our access to low cost aerial applications to increase the number of aerial fertilizer applications and we made a final urea application to Fields 1 and 2 (total of 4 in each) on September 1st, following our corn's surprisingly rapid biological development.

Despite pollination issues due to afternoon heat, we are pleased to see the high number of viable ears that have emerged, and we look forward to seeing evidence that our continued investment in (pre-planting) P and K will help ensure strong kernel development during our final field survey (and especially at harvest!)

The following summary table provides an overview of our initial plant nutrition program.

Fertilizer Application (lbs./acre)	N	P	K
Base	44	110	78
Liquid (fast uptake)	11	7	3
Urea	152	0	0
Foliar	0	0	0
Total	**207**	**117**	**81**
150 Bushels/Acre Maintenance (lbs./acre):	*188*	*66*	*42*
Fertilizer Build / Draw (lbs./acre):	**19**	**51**	**39**
110% Fertilization requirement surplus:	**0**	**44**	**34**

The June 19th, 2017 Farming Report has a detailed discussion of our fertilizer program; it is available upon request.

Insects

Insect pressure has been high throughout this season, although our aggressive insect management program continues to be effective thanks to a very proactive approach.

Our insect management program included the following applications:

- Initial our corn seed treatment (Syngenta's Fortenza®)
- Post planting insecticide application (DuPont Coragen®)
- Syngenta Karate®: (just registered in Belize; a suitable alternative to DuPont Coragen®)
- Syngenta Engeo® 247SC along with a phtyonomic oil as an additional suffocation agent.

We are continuing to monitor insect activity very closely, but we are now leaving the "danger zone" and do not expect significant insect risk during the last 30 days prior to harvest.

Funguses and Bacteria

We began our fungus/bacteria management program using Syngenta's Amistar® in an initial prophylactic application on September 1st, during a simultaneous application with the insecticide Karate®. A second application took place on September 28th.

In light of the heavy rains in the first nine days of October we will be closely monitoring the crop for any evidence of fungus/bacteria as the crop enters its final month. Continued heavy rains during the last phase of the crop would increase the risk of aflatoxin and other disease development, so it is essential to remain vigilant.

Weeds

This year's weed control program combined proactive spraying of glyphosate during periods when fields were not cultivated, adequate field preparations, and post-planting application of Syngenta's Calaris®.

As we come into the final phase of the crop, and the corn plants begin to dry down and provide more light to the soil, we expect to see some weed development, although we would not expect these to unduly impact the corn crop or its harvest. There is no available treatment at this time, although we may make a final glyphosate application shortly a week or two prior to harvest.

Harvest

In light of the corn crop's rapid development, we maintain our estimate for the start date for the harvest to start to the week of November 13th. This date may fluctuate modestly depending on weather conditions as our corn begins to dry down in early November.

Data from the most recent field survey, which included a viable ear count, confirm our expectation that, despite the pollination issues with this year's crop, overall yields from Cayo One will average between 7.0 and 8.5 mt/Ha (110 – 135 Bu/Acre)

Due to the absence of CSA's pilot between September 15th and October 9th no aerial photographs were made between September 12th and October 9th

Cayo One Day 70: Counting Kernels – Sep 26, 2017
Over 300 Ears were analyzed during the Field Survey

Cayo One Day 70: Impacto® Ears – Sep 26, 2017
Ears well formed and healthy – but note incomplete pollination

Cayo One Day 83: Impacto® Ear – Oct 9, 2017
Ear is filling well with full healthy kernels: about 430

Cayo One Day 70: Pioneer® 4226 – Sep 26, 2017
Ears well formed and healthy – but note incomplete pollination

Cayo One Field 1+2 Northerly aerial view – Oct 9, 2017
Fields are in good condition, about 35-40 days from harvest

Cayo One Field 1+2 Southwesterly aerial – Oct 9, 2017
Fields are in good condition, about 35-40 days from harvest

Cayo One Field 1+2 Easterly aerial view – Oct 9, 2017
Fields are in good condition, about 35-40 days from harvest

Cayo One Field 1+2 Southerly aerial view – Oct 9, 2017
Fields are in good condition, about 35-40 days from harvest

Banana Bank Aerial View – October 9, 2017
5 miles W of Cayo One: late May plantings ready to harvest

Kitty Bank Aerial View – October 9, 2017
3 miles NW of Cayo One: Harvesting: some good, some poor

Market Conditions and Conclusion

Corn

Global corn prices are steady around recent lows, with Gulf Ports prices at ~$149/mt for US #2 Feed Grade corn. This equates to ~$185/mt FOB Puerto Quetzal (Guatemala) and $250/mt CIF Melchor (Belize-Guatemala border crossing). The breakeven duty paid CIF price delivered in Belize would be ~$358/mt, or BZD 32.45/cwt

Domestic Belize prices continue to be weak as the 2017 harvest season approaches and local mills and dealers talk the price down. Prices have now fallen to the $220-$230/mt range (BZD 20.00-21.00/cwt).

We continue to see (from the air) a wide dispersion of field quality throughout the country, and it will be interesting to see if recent acreage increases keep total Belize production rising. Once again, many local farmers will find 2017 to be another difficult year owing to the combination of disappointing yields and low prices…

Edible Beans

Global prices for beans are trading erratically, with black beans falling to $700/mt FOB China, while Mexican CIF prices remain considerably higher at ~$1,150-$1,200/mt. US Dealer prices, with the 2017 harvest coming in, have slipped to ~$800/mt FOB.

Soybeans

Global prices remained steady, with Gulf Ports traded unchanged around ~$368/mt, which equates to ~$408/mt FOB Puerto Quetzal and $472/mt CIF Melchor border crossing. The breakeven duty paid CIF price (Belize delivery) would be ~$665/mt, or BZD 60.00/cwt

Domestic Belize prices once again remain steady, as they have for an extended period of time, with Grade #1 soy bean prices being quoted in the $560-$580/mt range (BZD 50-52.00/cwt), although there is little activity.

We anxiously await the end of the Hurricane season, as 2017's considerable activity continues to rattle Belize's farmers. Harvey and Nate spared Belize, but they and Irma, José, and Maria did considerable harm elsewhere.

We continue to be encouraged by the appearance of our crop, although we were somewhat disappointed by the impact of high afternoon heat on pollination levels. Nonetheless, the strength and viigor of our plants and ears leave us feeling quite positive. We will be vigilant over the last 30 days of our crop regarding any pest and disease issues, which we will rapidly address.

We are now at week 13 of an 18 week crop cycle and are in the final "fill" phase of our crop's development. This is the "home stretch" towards what we hope will be the best harvest ever at Cayo One.

Local markets are increasingly rattled by contiued weakness in North American markets, while the historic trends of weaker prices approaching harvest continues…

We continue to hope that Lady Luck will maintain her so far benevolent attitude for the final part of the season…

Thanks! - Abram Dyck, John Peters, and the Farming Report Editorial Team

Grower	Location	Field #	Ha/ Acres	Irr ?	Soil Type	Crop	Seed Variety (count/Ha) (count/acre)	Plant Date	Stand Date	Fertilizer Program *(For full details of applications, refer to Lot Records)*	Comments
BSA	Cayo One	1	75/ 185	N	Black	Corn (Yellow)	Syngenta Impacto 70,000 28,340	July 17-18	July 20	Base 12-24-12 330lbs/acre 0-46-0 85lbs/acre 0-0-60 68lbs/acre 40-0-0-5.6 (S) 100lbs/acre 40-0-0-5.6 (S) 70lbs/acre 40-0-0-5.6 (S) 68lbs/acre 40-0-0-5.6 (S) 70lbs/acre	Near ideal seedbed and planting conditions. Stand emerged and established by July 20. Stand is Uniform and Vigorous at Day 11 – July 31 V-6 to V-7and healthy although slight signs of water stress – Aug 14 Solid growth thanks to less rain and generous fertilizer: V-11 to V-12 at Aug 28. Continued solid growth and early R-1 at Sep 11. Promising Crop well into R5 at Oct 9.
BSA	Cayo One	1a	4/ 10	N	Black	Corn (Yellow)	Pioneer 4226 70,000 28,340	July 18	July 20	Base 11.1-28.6-20.2 385lbs/acre 40-0-0-5.6 (S) 100lbs/acre 40-0-0-5.6 (S) 70lbs/acre 40-0-0-5.6 (S) 68lbs/acre 40-0-0-5.6 (S) 70lbs/acre	Western side of Field 1. Near ideal seedbed and planting conditions. Stand emerged and established by July 20. Stand is Uniform and Vigorous at Day 11 – July 31 V6 to V7 and healthy although slight signs of water stress – Aug 14 Solid growth thanks to less rain and generous fertilizer, but higher evidence of illnesses: V-11 to V-12 at Aug

											28. Continued solid growth and early R-1, with no worsening of illness patterns at Sep 11. Promising Crop well into R5 at Oct 9.
BSA	Cayo One	1N	34/ 83	N	Black	Corn (Yellow)	Syngenta Impacto 70,000 28,340	TBD	TBD	Base	Decision made not to plant on August 15th. Insufficient time to complete landworks. Promising Crop well into R5 at Oct 9.
BSA	Cayo One	2	122/ 301	N	Black	Corn (Yellow)	Syngenta Impacto 70,000 28,340	July 15-17	July 18	Base 11.1-28.6-20.2 385lbs/acre 40-0-0-5.6 (S) 100lbs/acre 40-0-0-5.6 (S) 70lbs/acre 40-0-0-5.6 (S) 68lbs/acre 40-0-0-5.6 (S) 70lbs/acre	Near ideal seedbed and planting conditions. Uniform emergence within 60-72 hours of planting Stand emerged and established by July 18. Stand is Uniform and Vigorous at Day 13 – July 31 V8 and healthy across the field with little to no signs of water stress – Aug 14 Impressive growth with healthy plants at V12 to V-14: August 28. Continued vigorous growth and mid R-1 at Sep 11. Promising Crop well into R5 at Oct 9.

Lot Records for Fields 1 and 2 (Zoom in to see details)

A new Lot Record is (still!) in development and will be provided in following reports