

**Belize Sustainable Agriculture, Ltd.**  
**Joint Venture Farming Report – September 3, 2013**

**General Overview**

During the week ended August 31, 2013 weather conditions were very wet! San Carlos received 10 inches of rain between August 26 and August 31; Blue Creek received from 6 to 8 inches of rain. Soil moisture is currently at the “water logged” stage in Blue Creek and “wet” in San Carlos. With San Carlos being of the red, well drained soil type, the 10 inches affect the crop less than the 6 inches in Blue Creek. The current forecast is for more rain, mostly light showers.

Our reports between now and harvest will continue to refer to a methodology used to estimate yields which was described in detail in our August 19, 2013 report and is based on the following Purdue University paper:

<http://www.agry.purdue.edu/ext/corn/news/timeless/yldestmethod.html>

**Thiessen Family Farms – 286 acres (143 Irrigated / 143 Dry – 100% Corn)**

Corn was planted May 28, 2013. The Thiessens are now finished with all major applications. The corn is now at its final height in the 8.5’-9.0’ range and the harvest now looks set for around the early part of the last week in September. The corn ears are ripening a little faster than expected, hence the earlier harvest. The plants are staying green or alive longer which is something that the farmers are not used to seeing very often. This does allow the ear to develop better.

Spider mites and worms were a little bit of a problem, the bigger problem was a lack of agro chemicals to treat them. This is an important and enduring lesson for future crops, especially as the acreages become larger. Key agro-chemicals will have to be pre-purchased and stocked in secure locations to ensure they are available immediately when needed.



Dekalb 7088 (Sept. 2, 2013)



Thiessen Corn Field – August 26, 2013

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Ear Comparison: selection of corn ears from Thiessen fields (left) and worm affected ear (right)

The Thiessen crop continues to look very good! At this point the Thiessens can only sit back and wait for the corn to get ready for harvest. Insects and weeds should no longer be of major concern, as the corn has progressed through its more vulnerable stages, although the fields will be subject to regular inspection and prompt remedial spraying. The ears are drying nicely, kernels are getting hard. Harvest should be in the last week of September. One spray application of Tordon or 2,4-D will be done this week for vines that are starting to show up and will be a problem for harvesting if not addressed.

As the pictures above show, there is clearly room for improved insect management as well as improved fertilization programs. While the ears on the left are all at least of reasonable quality, the furthest one on the left looks almost perfect and has a kernel count in the upper 600s whereas the right hand one is in the low 400s. The two right hand ears appear to have suffered from both insufficient fertilization and some worm damage. The ear in the right hand picture appears to have suffered from fairly serious worm damage as well as some fertilizer issues. It had a kernel count just below 400.

As a reminder, using the basic yield calculation method of ears per acre x kernel per ear / kernels per bushel, we can create a goal:  $32,000 \text{ seed count/acre} @ 95\% \text{ plant germination rate} @ 95\% \text{ pollinated ear per plant} \times 600 \text{ kernels} / 85,000 = 204 \text{ Bushels / Acre (12.8mt/ha)}$ . This should be the long term goal for irrigated ground in Belize. It will take a number of years to get there, but the first step is better understanding where the weaknesses are and how to improve them...

We have already begun discussions with our JV partners to implement various insect management programs that are much more proactive than historical norms in Belize. As an example, placing baited traps in the corn fields to detect worm moths as soon as they appear in numbers would allow for more timely spraying before moths can lay large numbers of eggs. A significant drop in ear worm damage could help increase yields by 15%-30%. This approach, costing only a few dollars per acre, could increase per acre revenues by \$100+.

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Fertilizer programs will also be developed via extensive and better controlled trials that measure the impact of various levels of macro and micro nutrients on various soil types using various application methods. As we have pointed out to our partners, who are already seeing some significant signs of success in this season's crop, it makes sense to spend well focused money on fertilizer if each dollar of investment can generate two, three or even four dollars of extra yield.

Preliminary Yield Data for Thiessen fields

No additional crop Survey was performed in the Thiessen fields since August 26<sup>th</sup>. We expect to do one final Survey shortly before harvest to assess kernel size.

**We are now maintaining our weighted average yield forecast from the Thiessen fields at 120 to 140 bushels per acre.** This compares with our initial blended (irrigated and non-irrigated) target of 100 bushels per acre, and historical blended yields of 85 bushels per acre.

**TF Plantations – 342 acres (259 Irrigated / 83 Dry – 100% Corn)**



The above picture overlooks Fields TF1, TF2T and TF3, also known as “the small pivot field”, which was planted on June 10-12, 2013 with seed varieties DeKalb 7088, Syngenta and Pioneer 30F35. TF2T is a trial plot which has strips of all 3 varieties, about double the fertilizer, and is almost 100% irrigated. 10 inches of rain were received at the TF farm this past week and the soil has good moisture levels. Since the soil is a well drained soil, drowning of the crop is not a problem.

This continues to be really good looking corn. All scheduled treatments are now finished and no further work except remedial spraying is expected until harvest, which should be mid October. Corn stands at about 7.5 – 8.5 feet tall. This field will also get an application of Tordon this week for vine control. There is also some grass that is showing itself in TF1, TF2 and TF3, indicating that the grass control was not ideal but should not materially affect yields.

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Preliminary Yield Data for TF Plantations Fields TF1 - TF2T - TF3

A third detailed survey was performed in the TF Plantation fields on September 2, 2013. The ear count and kernel counts were as follows:

TF1 / Irrigated: 39 ears with a kernel average of 563 – Theoretical Yield: 150 bushels / acre

TF2T / Irrigated (Dekalb): 40.5 ears with a kernel average of 564 – Theoretical Yield: 156 bushels / acre

TF2T / Irrigated (Syngenta): 56 ears with a kernel average of 493 – Theoretical Yield: 167 bushels / acre

TF2T / Irrigated (Pioneer): 49.5 ears with a kernel average of 473 – Theoretical Yield: 160 bushels / acre

TF3 / Irrigated: 44.5 ears with a kernel average of 485 – Theoretical Yield: 147 bushels / acre

TF4 / Irrigated: 38.5 ears with a kernel average of 572 – Theoretical Yield: 150 bushels / acre

Compared with the 8/26 Survey, we note that kernel count has stabilized, which would indicate that we have seen the worst of the ear worm damage. We did not survey the non-irrigated portions of TF1 and TF3 which would typically lower yields, albeit not that much on a weighted average basis.

Given the above data, **we are maintaining the weighted average yield from the TF Plantations fields TF 1-2-3 to 125 to 145 bushels per acre, and setting TF4 at 130 to 150 bushels per acre.** This compares with our initial blended (irrigated and non-irrigated) target of 107 bushels per acre, and historical blended yields of 90 bushels per acre. The TF Plantations yields (historic and target) are higher than the Thiessen yields principally due to higher percentages of irrigated land.



TF Plantation Field TF4 (Sept. 2, 2013)



TF Plantation Field TF4 (Sept. 2, 2013)

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The above pictures are from Field TF4, also known as “the Large Pivot field”; it was planted 27-28 June, 2013. Seed varieties planted are Pioneer 30F35 - 75 acres, DeKalb - 7088 - 23 acres and Syngenta - 105 acres. The corn is very good looking! It seems that Brian Fehr (son of owner Henry Fehr) has been able to control the pests quite well even though worms have been problematic in TF1/2/3. The plants are now fully grown, 8.5 feet (102 inches) tall. Yesterday I saw a few plants still silking. Preliminary yield data remain very promising

**D&H Farms** – 224 acres (0 Irrigated / 224 Dry – 125 acres Corn / 99 acres Soybeans)

### **Soybeans**

The soybeans were planted June 27-28 and they are currently about 28 - 30 inches tall. 7 inches of rain fell this week on this field and soil conditions are now distinctly in the wet category. This field still has a bit of a grass problem; it does not seem to be affecting the plants too much in the flowering at this time. Plants are looking good: they have grown nicely this last week and continue to improve in color. Typical plant height for this variety (Huasteca 400) is around 30”-34”; these plants currently are ~28”. I expected them to be full height by the time they finish blossoming. This variety is more resistant to disease and high moisture, but can also take drier conditions than other varieties. The third and fourth picture below, show that the plants are loading up nicely with flowers and pods. The rain that we have been having this last week is a bit of a concern for flowering. However, so far I have not seen any flowers or pods fall off due to rain or fungus.



D&H Soybean Field (Aug 31, 2013)



D&H soybean field (Aug 31, 2013)

(Pete checking his soybeans)

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D&H Soybean Field (Aug 31, 2013)



D&H Soybean Flowering (Aug 31, 2013)

**Corn**

In the picture below, which shows corn from a small field of some 24 acres planted on June 11, the corn is above 7 - 8 feet high. This field received 6 inches of rain this week. It is very healthy looking corn. The corns silk is drying off nicely.



D&H Corn (Aug 31, 2013)



D&H Corn (August 25, 2013)

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We re-surveyed the “double strip” on the 24 acre field (received double seeding and double base fertilizer) and obtained the following results

DHC1 / Non-Irrigated: 52.5 ears with a kernel average of 537 – Theoretical Yield: 192 bushels / acre

This sample confirms our initial sample, which showed a high ear density, although the kernel count is lower. It confirms the need for further analysis of optimum plant density in dark, heavy soils.

**We are maintaining our forecasted weighted average yield from this small D&H field of 100 to 120 bushels per acre.** This compares with our initial target of 71 bushels per acre (!), and historical blended yields of 70 bushels per acre.



D & H Field 2 (Aug 31, 2013)



D & H Field 2 (Aug 31, 2013)

The above pictures are of field DHC2 (field 2), the last of the JV crops to be planted this season, which was planted on Friday the 26<sup>th</sup> of July. This field received a glyphosate burn down application hours before planting. The field is cleaning up nicely from the burn down. Corn varies in size from 18 to 26 inches tall on the east side (left picture) of the field and 26 to 38 inches on the west side (right picture) of the field. This difference in height in a certain area is mainly due to water logging at certain points of the field especially after constant heavy rains like last week. The difference in height between the east side and the west side is fertilizer. The west 30 acres got an additional 2.5 gallons of liquid fertilizer at planting. With some extra nitrogen we believe this field will still do well. The corn is looking greener this week than last week, a step in the right direction. An application of 46-0-0 was applied last week and going forward we will be applying three different levels of nitrogen to the field, and will report on this as the season goes forward. The late planting means that this crop will probably be harvested around December 1<sup>st</sup>, but our view was very much “better late than never”. Early growth is encouraging...

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**Neufeld Family Farms – 117 acres (0 Irrigated / 117 Dry – 100% Soybeans)**

Jacob Neufeld finished planting on June 28, 2013, and despite what looked at first like a low stand on his field, the crop is now looking very good. These fields have received several inches of rain in the last week, although the red soils in the San Carlos area tend to drain very well. These beans are really looking good! As can be seen below the beans are starting to flower nicely. Plants are 32 - 38 inches tall.



Field #JN4- Planted June 28, 2013: 20 acres



Field #JN3- Planted June 27, 2013: 17 acres



Field # JN2 - Planted June 27, 2013: 20 acres



Field #JN1 – Planted June 27, 2013: 60 acres

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JN1 Picture on the left you can see large pods and more small pods forming.

As can be seen in the pictures below, the beans are almost finished with flowering. It looks like a lot of pods are forming.



JN2 at tail end of Flowering (Aug 31, 2013)



JN3 in full flowering (Aug 26, 2013)

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**Summary and Conclusion**

Overall the crops continue to look really good; I continue to be very pleased with how all the fields have improved. All the corn fields are looking exceptionally good, and are the best our partners' can remember seeing! Blue Creek and San Carlos both continue to have high moisture levels, and we hope for drying conditions over the next week or two...

Grain prices have softened a little bit more from last week at the lowest levels of the year. Corn is now selling for BZD 0.255/lb (\$7.14/bushel); Soybeans are at BZD 0.55/lb. (\$16.50/bushel); Milo is at BZD 0.22/lb. Belize Corn continues to maintain an attractive premium to the Chicago near contract (~\$4.90/bushel).

**Early indications for corn yields continue to be very encouraging! Thanks to the progress at TF4, and despite the corn ear worm impact at TF1/2/3, we are feeling comfortable that achieving an average corn yield of >130 bushels/acre will be possible. The two remaining unknowns are kernel size and combining losses; we will have a feel for the former within two weeks and the latter by the time the Thiessens complete their harvest in less than 4 weeks' time.**

**As a reminder, 130 Bushels/acre for corn would be 30% above our original JV target and 50% over historical yields in Orange Walk.**

**We continue to find more and more areas on which to focus additional research in future crops. We are convinced that there will be numerous ways to enhance yields, each bringing a modest but material contribution, so as a whole we are beginning to consider that the long term objective should be to double Belize's historical yield levels.**

Thanks!

Abe Dyck

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<b>Grower</b>	<b>Location</b>	<b>Field #</b>	<b>Acres</b>	<b>Irr?</b>	<b>Soil Type</b>	<b>Crop</b>	<b>Seed Variety</b>	<b>Plant Date</b>	<b>Stand - Date</b>	<b>Fertilizer Program</b>	<b>Comments</b>
<b>Thiessen</b>	SC	1	143.0 142.8 <u>285.8</u>	Y	Sandy loam (Red)	Corn	DeKalb 7088 (25,000 seeds/acre)	May 28	6.5' - 7/13 7.5' - 7/19 8.5' - 7/27 8.5' - 8/3 8.5' - 8/19	170lbs/acre 18-46-0 183lbs/acre 46-0-0	Fertilizing complete. Total pure N this season = 115lbs/acre, versus historic 40-50lbs/acre. Note lack of "K" vs TF fields. Silking underway late July Silk starting to dry off on some ears` Kernels are getting hard 8/19 Ears continue ripening/browning 9/2 <b>Very Healthy</b> <b>High Yield Forecast</b>
<b>TF Plantations</b>	SC	TF1	57.99 14.00 <u>71.99</u>	Y N	Sandy loam (Red)	Corn	DeKalb 7088 (31,000 seeds/acre)	June 10	18" - 7/13 36-42"-7/19 48" - 7/27 8' - 8/3	220lbs/acre 10-26-26 110lbs/acre 0-0-60 65lbs/acre 40-0-0-6 148lbs/acre 46-0-0	Fertilizer program calls for 330lbs/acre base Fertilizer and 150 lbs/acre pure N. This is over 150% higher than historic levels and consistent with requirements for 125-150Bu/acre yields Silking underway 8/3 Silking finished, silk drying off 8/19 Ears continue ripening 9/2 <b>Healthy, with some ear worm</b> <b>High Yield Forecast</b>
<b>TF Plantations</b>	SC	TF2T Test Plot	14.72	Y	Sandy loam (Red)	Corn	DeKalb 7088 Syngenta Pioneer 30F35 (38,000 seeds/acre)	June 11	18" - 7/13 36-42"-7/19 47" - 7/27 8' - 8/3 8' - 8/19	330 lbs/ acre 10-26-26 330 lbs/ acre 0-0-60 140lbs/acre 40-0-0-6 260lbs/acre 46-0-0	Test Plot getting major fertilizer boost (up to 100% extra) vs. TF1 and TF3 (which are already way above historic levels) Harvest will be monitored for different result vs. TF1 & TF3 Silking underway 8/3 Silking finished, silk drying off 8/19 Ears continue ripening 9/2 <b>Healthy, with some ear worm</b> <b>High Yield Forecast</b>
<b>TF Plantations</b>	SC	TF3	46.40 5.59 <u>51.99</u>	Y N	Sandy loam (Red)	Corn	Pioneer 30F35 (31,000 seeds/acre)	June 12	18" - 7/13 36-42"-7/19 46" - 7/27 7' - 8/3	220lbs/acre 10-26-26 110lbs/acre 0-0-60	Same strategy as TF1 Little bit slower in silking 8/3 Silking finished, silk drying off 8/19 Ears continue ripening 9/2

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									8' – 8/19	65lbs/acre 40-0-0-6 148lbs/acre 46-0-0	<b>Healthy, with some ear worm High Yield Forecast</b>
<b>TF Plantations</b>	SC	TF4	140.02 63.56 203.58	Y N	Sandy loam (Red)	Corn	Pioneer 30f35 75 acres DeKalb 7088 23 ac. Syngenta 105 ac. (27,000 seeds/ac).	June 27-28	7-8" – 7/13 12-14" -7/19 30-36" –7/27 42-46" – 8/3 7-8.5' -8/19	220lbs/ac 18-46-0 110lbs/ac 0-0-60 142lbs/acre 46-0-0	Same strategy as TF1, some difference in fertilizers due to local availability issues. Tasseling and silking 8/19  <b>Very Healthy</b>
<b>D &amp; H</b>	BC	DHS1	99.37	N	Heavy Black	Soy	Huasteca 400 33.44 lbs/acre ~94,000 seed/acre	June 27-29	3-4" – 7/13 7-8" – 7/19 8-10" – 7/27 10-12" – 8/3 14-18" –8/19 24-28" –8/25	40lbs/ac 15-15-15	Summer soybean trial in heavy black Blue Creek soil. Limited Fertilizer program due to modest soybean needs and local soil conditions. Compare with JN. Crop Replanted June 27-28 after first seed had very low germination rates.  <b>Now looking promising</b>
<b>D &amp; H</b>	BC	DHC1	24.43	N	Heavy Black	Corn	DeKalb 7088 (Seeds/acre 26,000)	June 11	3.5' – 7/13 5' – 7/19 6.5' – 7/27 7-8' – 8/3 8'+ - 8/19	100lbs/acre 14-36-12 65lbs/acre 46-0-0	Summer corn trial in heavy black non-irrigated Blue Creek soil. Fertilizer program calls for 150lbs/acre base Fertilizer and 75 lbs/acre pure N. (low range but 50% above historic levels)  <b>Mostly Very Healthy</b>
<b>D &amp; H</b>	BC	DHC2	100.56	N	Heavy Black	Corn	DeKalb 7088 Syngenta Pioneer 30f35 (seed rate 28,000)	July 26- 27	4" – 8/3 16" -8/19 16-36" -8/25	192 lbs/ac 14-36-12 40 lbs/ac 46-0-0 50 lbs/ac 46-0-0 50 lbs/ac 46-0-0	Same as DHC1  <b>Very Promising 8/19 Some concern re water 8/26</b>
<b>Neufeld</b>	SC	JN1	60.73	N	Sandy loam (Red)	Soy	CARDI 1088 28 lbs /acre ~78,000 seed/acre	June 27	4-6" – 7/13 7-8" – 7/19 8-10" – 7/27 15-19" 8/3 27-33" -8/19	120lbs/acre 15-15-15	Summer soybean trial in sandy red soil. Fertilizer program calls for moderate increase in base and foliar applications

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									30-36"-8/26 32-38"-9/2		<b>Now looking very good given below average germination rate</b>
<b>Neufeld</b>	SC	JN2	20.17	N	Sandy loam (Red)	Soy	CARDI 1088 28 lbs/acre ~78,000 seed/acre	June 27	4-6" – 7/13 7-8" – 7/19 8-10" – 7/27 15-18" – 8/3 27-33"-8/19 30-36"-8/26 32-38" -9/2	120lbs/acre 15-15-15	Same as JN1  <b>Now looking very good given below average germination rate</b>
<b>Neufeld</b>	SC	JN3	16.56	N	Sandy loam (Red)	Soy	Huasteca 400 28 lbs/acre ~78,000 seed/acre	June 27	4-6" – 7/13 7-8" – 7/19 8-10" – 7/27 16-19" – 8/3 27-33"-8/19 30-36"-8/26 32-38" -9/2	120lbs/acre 15-15-15	Same as JN1  <b>Now looking very good given below average germination rate</b>
<b>Neufeld</b>	SC	JN4	19.82	N	Sandy loam (Red)	Soy	CARDI 1088 28 lbs/acre ~78,000 seed/acre	June 28	4-6" – 7/13 7-8" – 7/19 8-10" – 7/27 15-18" – 8/3 27-33"-8/19 30-36"-8/26 32-38" -9/2	120lbs/acre 15-15-15	Same as JN1  <b>Now looking very good given below average germination rate</b>