

Belize Sustainable Agriculture, Ltd.
Joint Venture Farming Report – September 17, 2013

General Overview

As I wrote last week, during the week ended September 7, 2013 weather conditions were very wet! Following that, this past week has continued with more rain. It seems that someone forgot to close the water tap somewhere! Soil moisture continues to be “water logged” in Blue Creek and “wet” in San Carlos. With San Carlos being of the red, well drained soil type, the continuous rains affect the crop less than in Blue Creek. We have now had almost daily rain for the last 4 weeks, this is unheard of. We are approaching levels for a “25 year event” for September rains; moreover, with a tropical depression in the western Caribbean, I expect a few more days of rain.

From a crop viewpoint we have now firmly entered the “Yellow Alert” stage. No serious crop damage has occurred, but if the current rains continue for another week to ten days, we would be likely to begin experiencing material crop damage. For those so inclined, you can follow Belize’s weather on:

<http://www.hydromet.gov.bz/250-km-radar-loop>

Please note that our reports between now and harvest will continue to refer to the methodology used to estimate yields which was described in detail in our August 19, 2013 report; it 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 and the corn is now at its final height of 8.5’-9.0’; the harvest is set, weather permitting, for late Sept. The corn ears ripened 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 allows the ear to develop better, and is likely to be the result of higher fertilization rates and a year of good rainfall. This is proving to be very beneficial, given the very wet conditions for so long; normally we would be seeing corn stalks start lodging or falling over due to a rotten root system if they were not still alive.

Spider mites and worms were a moderately severe problem this season; 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.



Thiessen Corn Field - Dekalb 7088 (Sept. 16, 2013)



Thiessen Corn Field – August 26, 2013

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September 9, 2013



Pioneer Left ear and Dekalb right ear (September 17, 2013)

Flooding is a bit of a problem on the south west part of the Thiessen field, but this week all the wet areas were scouted and we found that less than 2 acres were affected by severe flooding. After some calculations it was decided that it would be more expensive to cut drains with it being so wet than losing the 2 acres of corn. It was decided to wait for the dry season to cut more drains. Some drains had been cut during the last dry season, but obviously not enough. This again shows that drainage is as important as irrigation.

Otherwise, the Thiessen crop continues to look very good! As we wrote in previous reports, at this point the Thiessens can only sit back and wait for the corn to get ready for harvest. Insects 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. A moisture test was done on several ears and the moisture averaged at 34%. Bear in mind that we have had almost continuous rain for the last few weeks and this will affect the moisture reading. Harvest should be in the latter part of the last week of September. One spray application of Tordon was applied several weeks ago for vines that are starting to show up and will be a problem for harvesting if not addressed. On inspection yesterday the vines were drying up very nicely.

As we anxiously await the harvest (and keep looking up to the skies for some lasting sunshine) we are pondering the main lessons of this season: The need for both improved insect management as well as improved fertilization programs.

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 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 26th. We expect to do one final Survey shortly before harvest to assess kernel size. A couple of ears were looked at yesterday and the kernels are ripening very nicely (see pictures above).

We continue to maintain 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 is taken from 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

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3 varieties, about double the fertilizer, and is almost 100% irrigated. There was no lack of rain 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.

Nothing has changed with these fields, which continue to look really good. 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 got an application of Tordon this week for vine control and the vines are also dying off nicely. 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. The ears are drying very nicely. No further worm damage is evident. The ears are drying off nicely while the stalk remains green, although the seriously wet weather is slowing down the drying process.

Once again, even with our rains being near perfect in the earlier part of this year's summer season, we saw how irrigation is so important. As we reported last week Tordon was applied via ground rig and Henry went along with the spray rig to have a closer look overall his field. The irrigated section of TF1/2/3, where the irrigation pump was started up 3 times early in the crop, shows corn plants that are significantly taller compared to where there was no irrigation.

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

No additional crop Survey was performed in the TF Plantation fields since September 2nd. We expect to do one final Survey shortly before harvest to assess kernel size. A couple of ears were looked at yesterday and the kernels are ripening very nicely.

We continue to maintain the weighted average yield from the TF Plantations fields TF 1-2-3 to 125 to 145 bushels per acre, and reducing TF4 to 120 to 140 bushels per acre due to incomplete ear formation. 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. 9, 2013)



TF Plantation Field TF4 (Sept. 16, 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. Silk is drying off nicely. Preliminary yield data remain very promising. All corn ears that were checked did not show any further signs of worms being present.

The projected yields look not too bad, but as can be seen in the picture, on the left below, nutrition is still an issue! There are considerable improvements to be made! If you look at what percentage of the ear is not filled, that is significant. The picture on the right is what concerns me if the rains won't let up soon. Kernels starting to grow, I only saw one, but a concern.



TF4 (September 16, 2013)



TF4 (September 16, 2013)

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, pretty much as tall as they will get. Rain has been constant 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. Plants are looking good: they continue to improve in color. Typical plant height for this variety is around 30-34"; these plants currently are 28-30". This variety (Huasteca 400) is more resistant to disease and high moisture, but can also take drier conditions than other varieties. We continue to see really nice nitrogen fixing nodules, which indicate a very healthy root system (which should also help the next crop!). The rain that we have been having these last few weeks was a bit of a concern for flowering. However, as can be seen in the pictures below, pods have formed very nicely. So far I have not seen any flowers or pods fall off due to rain or fungus. Fungus risk due to the constant rain is an increasing concern.

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Another survey of the D&H Soybean field was carried out yesterday, and the pods are starting to fill nicely. Another week and we hope to be able to give a better idea on how many pods are filling. Therefore we cannot accurately assess the true pod count, which is a critical data point. What we can say is that plant count remains low (~52k/acre) but with a high pod count (~80). The critical factor to assess yield will be what percentage of the pods which have formed will fill out. There was no significant drop in pod count from last week, and most pods appear to be filling out nicely. However, as we won't have a good feel for this for another week, we will defer any yield estimates until then



D&H Soybean Field (September 16, 2013)



D&H Soybean Field (Sept 16, 2013)

Corn

The small field of some 24 acres planted on June 11, the corn is above 7 - 8 feet high. This field received lots of rain this week, just like all other fields. It is very healthy looking corn and the corn silk is drying off nicely. No further worm damage is evident.

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No additional crop Survey was performed in the DHC1 Corn field since August 26th. We expect to do one final Survey shortly before harvest to assess kernel size.

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 (Sept 16, 2013)



D & H Field 2 (Sept 16, 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 26th 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 24 inches to 6 feet inches tall on the east side (left picture) of the field and 4 - 6 feet 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 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 on Saturday. We had hoped to do a little more experimenting with differing N rates, but the field is starting to tassel, which means no more N. This field has really suffered from excessive water! I will be very happy if we get our expenses back from this field. The late planting means that this crop will probably be harvested around December 1st, but our view was very much “better late than never”. With the rain having continued this week it has been a bit of a problem applying urea (46-0-0). Foliar applications of N have been applied via air. Again drainage is so very important. This is an important lesson for the Cayo 1 property, which is predominantly composed of rich, dark soil. Designing and implementing an extensive drainage network will be critical for protecting crops in years like 2013 where we have had significantly above average rainfall.

Neufeld Family Farms – 117 acres (0 Irrigated / 117 – 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 lots of rain in the last week, although the red soils in the San Carlos

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area tend to drain very well. These beans are really looking good! The fields are finished with flowering and pods are forming very well. A pod count was done yesterday.



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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A preliminary survey of the four Neufeld soybean fields was carried out on September 9th, and reconfirmed this week. As with the D&H field, it is too early to draw any reliable conclusions as the pods are forming; we also expect that they will fill out in the course of the next week.

What we can say is that plant count is very low (~27k/acre), which is likely due to insufficient seed being available at the time of planting and poor germination (this is similar to the problems Pete Dyck experienced on his soybean field which he re-planted). On the other hand, pod count remains extraordinarily high (~150!!!), and they appear to be filling out nicely. So the critical factor to assess yield remains what percentage of the pods which have formed will fill out completely. As with the D&H field, we won't have a good feel for this for another week, so we will defer any yield estimates until then.

An important early conclusion we are drawing for soybean farming in Belize is how important it will be to have the right quality of soybean seeds (e.g. high germination rate) and to plant to the right density. This will likely require conversion to 15" rows from 30" rows (subject to trials). Historically the main reason this has not been done in Belize is the lack of specialized equipment (which is not that expensive!), as well as the continuation of past farming practices ("That's how my father and grandfather did it!").

A well cared for Soybean field that has a plant density of ~100,000 plants which produce 30 to 40 good pods will yield 50 to 66 bushels per acre. We believe that, on irrigated ground and with proactive pest and disease management, these will be achievable yields. They will make soybean farming in Belize highly profitable!

Summary and Conclusion

We continue to be well pleased with how the various crops have developed, and most of them continue to look really good. What we now need is for the rains to stop and the sun to come out! This should be happening, based on normal year rain patterns, but these days, what's normal? Once things dry out we can start harvesting.

Grain prices were unchanged from last week at the lower levels. 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 (~\$4.50/bushel). The Blue Grain Coop manager yesterday said that he felt that milo prices would go down once harvesting started because of the local farmers who do not have storage. He forecasted BZD 0.19/ lb during harvest. This has been a persistent issue in Belize, where prices drop at harvest time and then recover in the next few months once the crops from farmers who have no storage have been absorbed.

Early indications for corn yields continue to be very encouraging; despite some ear formation issues at TF4 and the corn ear worm impact at TF1/2/3 and the recent rains, we remain comfortable that achieving an average corn yield of around 130 bushels/acre will be possible. The two remaining unknowns remain kernel size and combining losses, although the latter should be minimal. Once the Thiessens complete their harvest we should know more about these.

As we wrote these last several weeks, 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 its contribution which allows us to think that the long term objective should be to double Belize's historical yield levels.

Thanks! - Abe Dyck

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Grower	Location	Field #	Acres	Irr?	Soil Type	Crop	Seed Variety	Plant Date	Stand - Date	Fertilizer Program	Comments
Thiessen	SC	1	143.0 142.8 <hr/> 285.8	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 + 9/9 Very Healthy High Yield Forecast
TF Plantations	SC	TF1	57.99 14.00 <hr/> 71.99	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 + 9/9 Ears drying nicely 9/16 Healthy, with some ear worm High Yield Forecast
TF Plantations	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 + 9/9 Ears drying nicely 9/16 Healthy, with some ear worm High Yield Forecast

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TF Plantations	SC	TF3	46.40 5.59 51.99	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 8' – 8/19	220lbs/acre 10-26-26 110lbs/acre 0-0-60 65lbs/acre 40-0-0-6 148lbs/acre 46-0-0	Same strategy as TF1 Little bit slower in silking 8/3 Silking finished, silk drying off 8/19 Ears continue ripening 9/2 + 9/9 Ears drying nicely 9/16 Healthy, with some ear worm High Yield Forecast
TF Plantations	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 Silking finished 9/9 Silk finished drying off 9/16 More worm damage than ideal 9/16 but no new worm damage Very Healthy
D & H	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. Looking promising, but water a concern
D & H	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) Mostly Very Healthy, but water a concern
D & H	BC	DHC2	100.56	N	Heavy Black	Corn	DeKalb 7088 Syngenta Pioneer 30f35	July 26- 27	4" – 8/3 16" – 8/19 16-36" – 8/25	192 lbs/ac 14-36-12 40 lbs/ac	Same as DHC1

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							(seed rate 28,000)			46-0-0 50 lbs/ac 46-0-0 50 lbs/ac 46-0-0 115 lbs/ac 46-0-0 65 acres 45 lbs/ac 46-0-0	Very Promising 8/19 but water a concern 9/9 water is getting the upperhand
Neufeld	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 30-36"-8/26 32-38" -9/2	120lbs/acre 15-15-15	Summer soybean trial in sandy red soil. Fertilizer program calls for moderate increase in base and foliar applications Now looking good given below average germination rate 9/2 Survey shows Low plant count with very high pod count 9/9 Pod count remains good 9/17
Neufeld	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 Now looking good given below average germination rate 9/2 Survey shows Low plant count with very high pod count 9/9 Pod count remains good 9/17
Neufeld	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 Now looking good given below average germination rate 9/2 Survey shows Low plant count with very high pod count 9/9 Pod count remains good 9/17
Neufeld	SC	JN4	19.82	N	Sandy loam (Red)	Soy	CARDI 1088 28 lbs/acre	June 28	4-6" – 7/13 7-8" – 7/19	120lbs/acre 15-15-15	Same as JN1

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							~78,000 seed/acre		8-10" – 7/27 15-18" – 8/3 27-33" -8/19 30-36"-8/26 32-38" -9/2		Now looking good given below average germination rate 9/2 Survey shows Low plant count with very high pod count 9/9 Pod count remains good 9/17
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