Yellow Corn in Virginia – Spring 2017

Mark S. Reiter[1,2], W. Hunter Frame[2,3], Wade E. Thomason[2], J. Scott Reiter[4], Janet Spencer[5], and Ursula Deitch[6]

[1]Eastern Shore Agricultural Research and Extension Center, Virginia Tech
[2]Department of Crop and Soil Environmental Sciences, Virginia Tech
[3]Tidewater Agricultural Research and Extension Center, Virginia Tech
[4]Prince George County, Virginia Cooperative Extension
[5]Isle of Wight County, Virginia Cooperative Extension
[6]Northampton County, Virginia Cooperative Extension

The Problem

Well, it's time for our annual publication that mentions yellow corn in Virginia. According to Meteorologist Scott Minnick with the NOAA-National Weather Service in Wakefield, VA, May 2017 is "yet another wet and cloudy May for the record books. With the rain on [May 31, 2017], Norfolk moved up to the 3rd wettest May on record." The 2017 growing year is almost identical to last year (the wettest May on record for Norfolk, VA), with a dry March and April leading into a record breaking cool and wet May as corn tries to establish roots. Young corn largely depends on residual and starter fertilizer prior to sidedress applications and these fractions can be impacted greatly with excessive rain.

Figure 2. Yellow corn from a cool and wet Spring on the Eastern Shore of Virginia (May 2017).

Many of the corn fields on the Eastern Shore and in Eastern Virginia are experiencing "yellow" and stunted growth due to the weather this Spring (Fig. 1) and is similar to conditions that Virginia farmers experienced in Spring 2016 (Fig. 2) and 2010. There are many reasons for the corn to be yellow that range from nutrient deficiencies to abiotic factors. Some reasons for yellowing include:

Figure 1. Yellow corn from a cool and wet Spring in Prince George County, VA (May 2016).

1. **Cold temperatures.** This Spring's temperatures were below normal for

much of the corn growing season so far (Figs. 3, 4, and 5). Yellow and purpling of corn is a common occurrence with cool weather. Yellow corn may seem to be a nutrient deficiency issue; however, the corn in Figs. 2 and 6 were tested and have adequate nutrient concentrations (Fig. 7). Actually, due to the concentrating effect of stunted growth, several nutrients like phosphorus (P) and nitrogen (N) have very high concentrations.

2. **Wet soils.** Virginia farmers went from a drought situation in March-April to non-stop rain in May (Figs. 3, 4, and 5). Saturated soils reduce aeration corn roots need for metabolic processes and nutrient uptake. During wet conditions, the entire corn plant may show yellowing and other different nutrient deficiency symptoms, such as purple leaves from P deficiency (Fig. 8).
3. **Lack of sunshine.** This definitely interacts with the first two factors. Corn plants convert sunlight to energy, which in turn drives growth and metabolism. The long stretches of cloudy days in 2017 have definitely contributed to the overall poor growth and lack of vigor.
4. **Nitrogen deficiency.** Many farmers utilize organic fertilizers, such as poultry litter or cover crops, as starter N fertilizer for corn production. Microbial conversion of organic N compounds to inorganic N (ammonium and nitrate) is slow during cold and wet soil conditions. Corn plants dependent on organic N will show N deficiency in cool wet years compared to normal weather years. Also, sandy soils may experience leaching as N moves down the soil profile with rain water. Heavier textured soils and areas that pond water can quickly become saturated. These saturated fields may lose N via denitrification. Nitrogen deficient plants will show a general overall yellowing and stunted growth (Figs. 1 and 9).
5. **Sulfur (S) deficiency.** Overall, S reacts very similar to N in the soil system. Slow organic matter mineralization will reduce available sulfate-S concentrations (the form of S taken up by plants). Soil organic matter is the largest reserve of S in most soils, so slow mineralization can limit available S, especially in the upper soil profile. Sulfate can also leach down the soil profile with rain water during large rain events. In figure 7, poor growth led to a N concentration effect; which

Figure 6. Yellow and striped corn plant in Spring 2016. This corn plant has adequate fertility according to book tissue concentration values. Prince George County, 2016.

Figure 8. Marginal purpling on corn plants in Spring 2017 from P deficiency. Purpling plus slug damage on the leaves was commonly seen during cool and wet conditions, especially in high-residue cover crops. Essex County, 2017.

Sample Id : **Bad**   Growth Stage : **Less than 12 inches (VE-V3)**

	Nitrogen %	Sulfur %	Phosphorus %	Potassium %	Magnesium %	Calcium %	Sodium %	Boron ppm	Zinc ppm	Manganese ppm	Iron ppm	Copper ppm	Aluminum ppm
Analysis	5.53	0.25	0.86	3.69	0.27	0.66	0.02	14	62	65	105	16	87
Normal Range	4.00	0.18	0.40	3.00	0.20	0.30	0.01	5	20	25	40	6	5
	5.00	0.50	0.60	4.00	0.60	0.80	0.03	26	61	160	251	21	301

	N/S	N/K	P/S	P/Zn	K/Mg	K/Mn	Ca/B	Fe/Mn	Ca/K	Ca/Mg
Actual Ratio	22.1	1.5	3.4	138.7	13.7	567.7	471.4	1.6	0.2	2.4
Expected Ratio	13.2	1.3	1.5	123.5	8.8	378.4	355.0	1.6	0.2	1.4

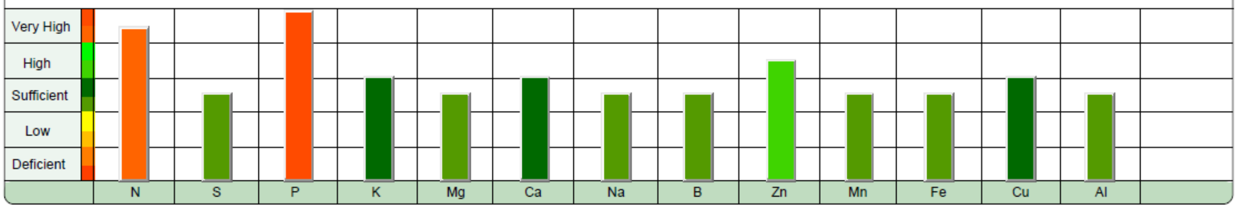

Figure 7. Corn plant tissue test showing adequate plant nutrition despite stunted and yellow corn plants in Figs. 2 and 6.

increased the N:S ratio that could also cause corn yellowing since the ratio is higher than 15 parts N to 1 part S (>15:1).

6. **Potassium (K) deficiency.** Potassium deficiency symptoms typically show up on larger plants, about knee high. The K deficiency symptoms appear first on older leaves, with yellow to brown coloration on the leaf margins.
7. **Soil pH.** The optimal pH for corn is between 6.0 to 6.5. However, we have seen reports with soil pH as low as 4.5. In a low pH field, acidic soil conditions solubilize aluminum that can damage the corn's roots; which inhibits nutrient and water uptake. The lack of nutrients can stunt corn and cause deficiency symptoms to appear. Soil pH problems will often

Figure 9. Nitrogen deficient corn on the left versus corn receiving starter fertilizer on the right. Prince George County, 2015.

Figure 10. Yellowing in the field caused by soil pH injury. The yellow area has a 5.1 soil pH; which injured roots in Isle of Wight County.

first appear in lighter, sandier textured areas while the heavier soils look to be growing normally (Fig. 10).

8. **Corn hybrid.** Some hybrids tend to show interveinal stripping more than other hybrids, and hybrids have different levels of greenness. Figure 11 shows a field planted on the same day with varying levels of corn greenness.

Figure 11. A greener corn variety to the right as compared to a yellower corn variety on the left. Both were planted the same day with identical fertilizer. Essex County, 2017.

Care should also be taken when using visual deficiency symptoms to diagnose crops. Visual characteristics are a start, but may be misleading as many nutrients exhibit similar symptoms that can easily be confused. For instance, many fields appear stunted and yellow and are diagnosed as a N deficiency when in fact sulfur deficiency is the main culprit. Likewise, stunted plants from cool and wet conditions may appear to look like the classic magnesium deficiency stripe that you find in nutrient management guides and on internet searches.

<u>The Solution: For Now</u>

The best way to diagnose nutrient deficiencies is to use tissue and soil testing. Many private labs can email or fax results back within a day or two after sample submission. For around $25, tissue tests will give exact nutrient concentrations and pinpoint what nutrients may be in short supply. Soil tests will show what the plant is actually able to secure from the soil in this growing season. For more accurate recommendations, submit a soil sample along with your tissue tests. For corn less than 12 inches tall, take 30 samples from the whole aboveground portion across the entire field. Between 12 inches tall and tassel, sample the upper-most fully developed leaf (leaf has a "collar"). Take a soil and tissue sample from both the "good" and "bad" area of the field. This will allow you to compare differences in your specific situation versus depending on book values from across the USA. Overall, the time and money it takes to test your corn is small compared to the fertilizer inputs you have already or will potentially invest. Also, sampling will ensure that you do in fact have a nutrient problem versus yellow and stunted corn from cool and wet weather.

Specifically for N, sidedress N applications are a great time to adjust for losses that may have occurred from the pre-plant and starter fertilizer applications due to leaching and denitrification. This is especially important if you are depending on mineralization from poultry litter or manure to supply N for this growing season. Guidance for using a pre-sidedress soil nitrate test to give you a better feeling of N fertility needs can be found in VCE publication 486-016 (https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/418/418-016/418-016_pdf.pdf). The key points to remember from this publication are that you should soil test 12-inches deep across the field. Each field (or 20 acres max per sample) should consist of 20 soil cores that are mixed together to represent that area. When soil sampling, be careful that not more than one soil core is taken from the starter fertilizer band and not more than one from the sidedress N band if you are considering a third N application (i.e. not more than 5% of cores should be from fertilizer bands).

Alternatively and preferably, you can just avoid starter and sidedress bands altogether if possible. One caveat with PSNT is that Virginia guidelines worked best on soils that received large quantities of organic N (i.e. manure and/or cover crops). However, the PSNT may still give you some guidelines for deciding if additional N applications are warranted for inorganic fertilized systems.

An alternative method for determining sidedress N applications may be simple adjustment using the rule of thumb that we apply 1 lb. N/acre for each expected bushel as a yield goal. For instance, if 3 of your last 5 years averaged 200 bu./acre for corn, you should expect to fertilize with 200 lbs. N/acre split between pre-plant, starter, and sidedress applications. As a combination of N uptake, denitrification, and leaching during May 2017, we generally now assume that little residual soil N is available. By V6 growth stage, around 30 to 50 lbs. N/acre is taken up by the plant. If you are estimating a 200 bu./acre yield, fertilized with 200 lbs. N/acre total, then you want to sidedress with 150 to 170 lbs. N/acre to ensure that you have a total of 200 lbs. N/acre available to meet yield expectations. Finally, this might be a good year to take a look at some of the proprietary N management tools that are available for determining site specific N programs based on local data. All tools work a little differently, but programs such as adapt-N (http://www.adapt-n.com/), Fieldview (https://climate.com/), or Encirca (https://www.pioneer.com/home/site/us/encirca/) can help predict N losses and needs to back up our guesstimates, just to name a few and not recommending one over another.

To correct other nutrient deficiencies, macronutrients (N, P, K, magnesium, and S) and micronutrients (zinc, boron, and manganese) important for corn production can be mixed into your side dress application when plants are knee-high. For farmers not applying side dress applications or are past this stage, foliar feed applications can be made and possibly incorporated with other maintenance sprays for micronutrients. Be sure you consult your tissue test recommendations, Virginia Cooperative Extension, or your local fertilizer dealer for recommended rates and products. Remember – Too much is not always better and source is important. Some nutrient sources have the potential for leaf burn which is not desirable for a plant already under nutrient stress. The correct source and rate are critical to efficiently correcting the nutrient deficiency.

The Solution: The Future

As always, the best way to correct a deficiency is to avoid it in the first place. All fields should be routinely soil sampled and fertilizer applied based on your soil's yield potential. Using Virginia Tech's soil testing laboratory, your soil's yield potential will automatically be calculated if you put your soil series on the soil sampling sheet instead of yield goal. Proper nutrient management can save more than headaches, it can reduce unnecessary fertilizer use, increase yields, and increase profits. For more information on proper fertilizer use and placement in field corn, consult Virginia Cooperative Extension publications #424-027 (nitrogen and phosphorus), #452-702 (macronutrients), and #452-701 (micronutrients).

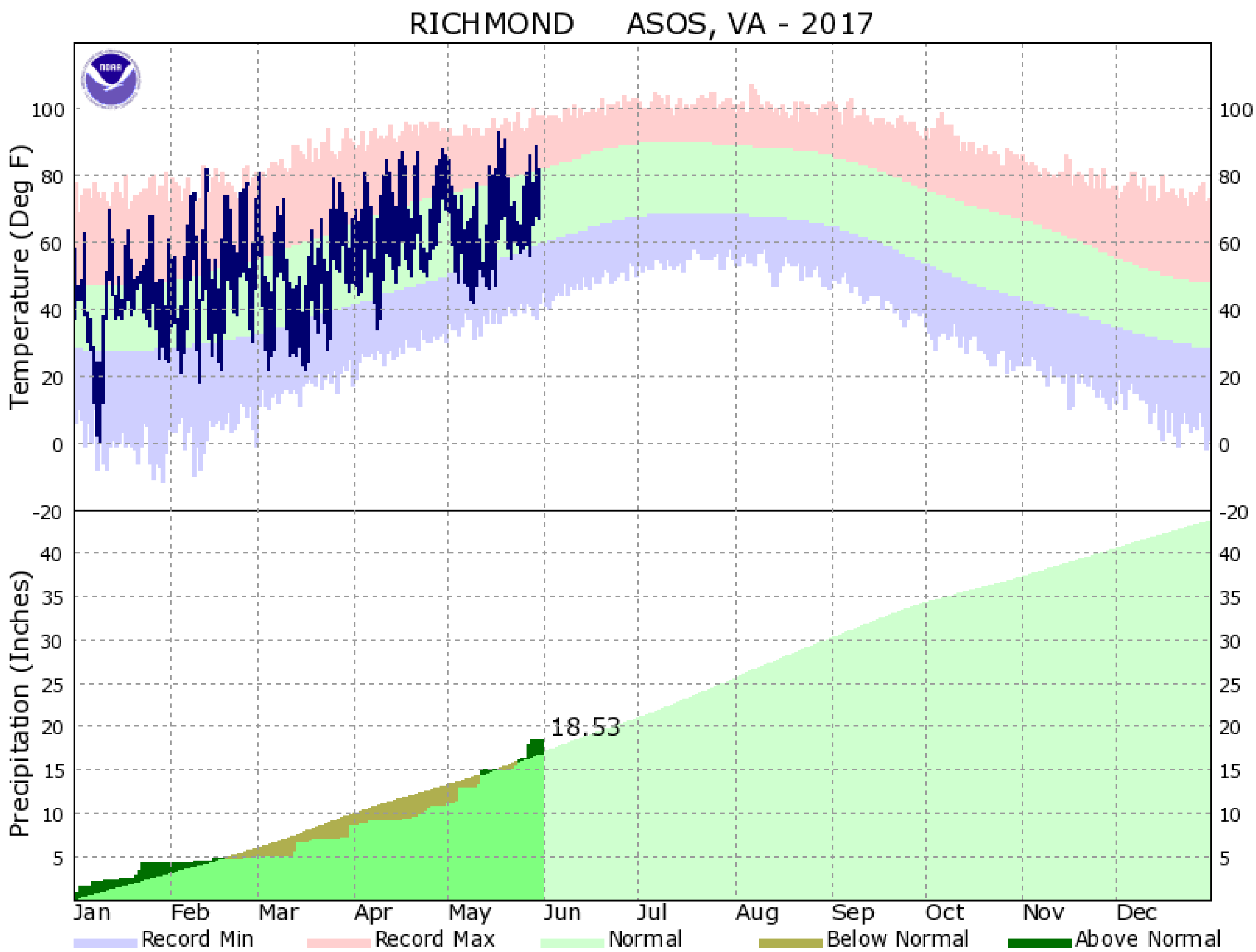

Figure 3. Richmond, VA temperature and rainfall climate data for 2017 (http://www.weather.gov/akq/CLIPLOT_MAIN).

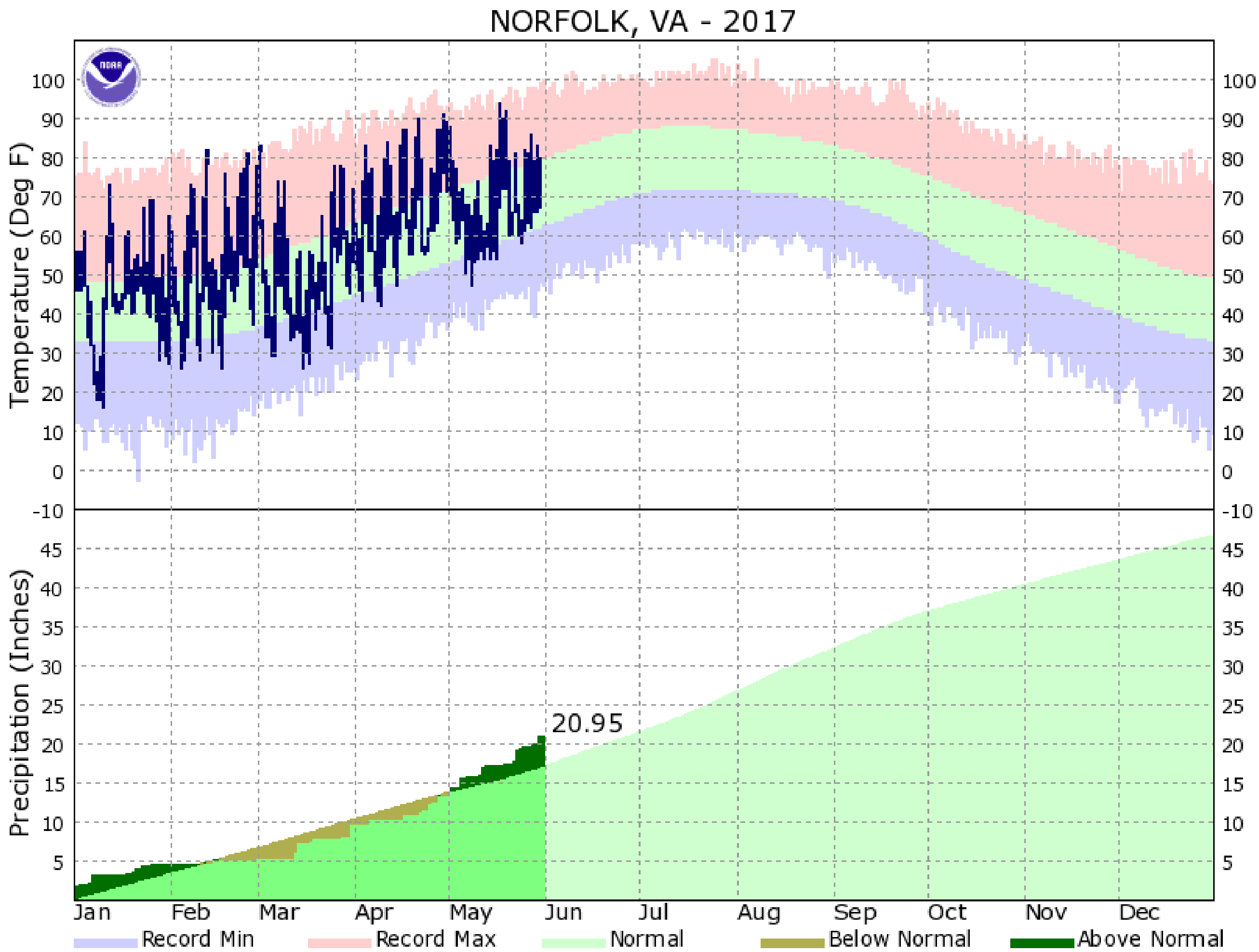

Figure 4. Norfolk, VA temperature and rainfall climatic data for 2017 (http://www.weather.gov/akq/CLIPLOT_MAIN).

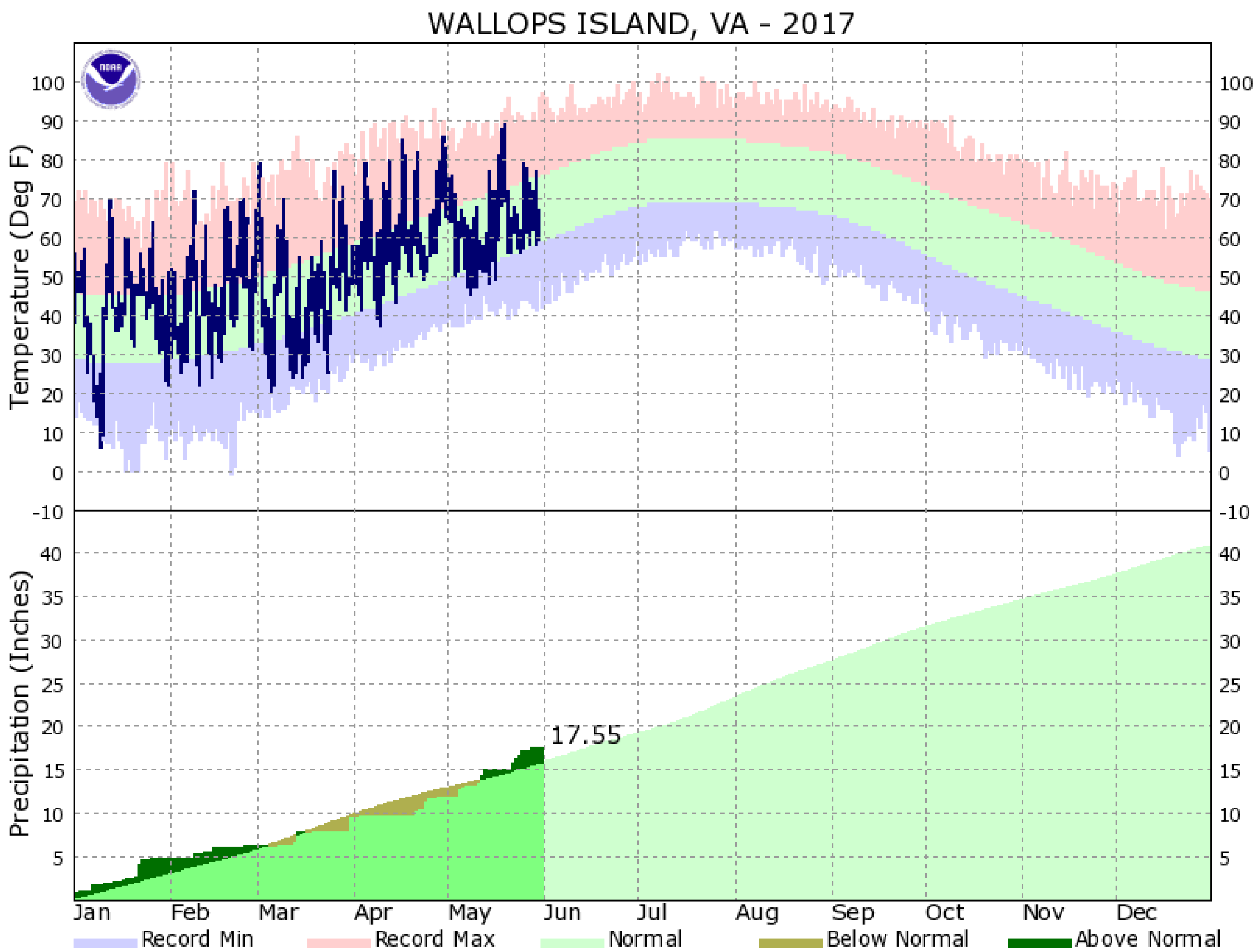

Figure 5. Wallops Island, VA temperature and rainfall climatic data for 2017 (http://www.weather.gov/akq/CLIPLOT_MAIN).