

Development of a New Potato Seepage Irrigation and Drainage Area in Hastings

Report – Deliverable 9b (FDACS – Contract # 017259) (UF – Contract # 0083268)

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Executive Summary

As soon as the funding for this project was released on October 17th, 2011, work was initiated to develop the 15.2 acres of new land at the Experimental Station at the Florida Partnership for Water, Agriculture, & Community Sustainability at Hastings. The main objective of this deliverable was to have a farm field that mimicked typical farm fields in the area, where IFAS could test, further develop, and evaluate tools to provide better irrigation and/or nutrient management for a variety of crops. This report discusses the development of the 15.2 acres of land to properly test wireless seepage irrigation management technologies on a field similar to that of a commercial field setting. The land leveling process began January 30th 2012 and was completed February 10th. The final stage of laying down the rows using GPS guided equipment was accomplished March 23, 2012. In the meantime, grades were shot for the drainage and tail water ditches. The ditches were dug and the pipeline was assembled, including spigots for each row and flow meters and solenoid valves for the three 4.3 acre “cells” in the farm field. The well was dug and the pump station was installed from May 4th-9th. The 6” pipe line was subsequently connected to the well May 10th. The tail water ditches were fitted with water retention structures (that will be automated in the next project phase) the week of May 21st 2012. The soil tilled, limed, fertilized and a summer cover crop was planted in May 2012.

Irrigation to the field was started via a temporary connection to an existing pump station in the vicinity of the field on May of 2012; the new pump station of the field could not be used, because the electric power provider had not connected the pump station to the existing electric power pole grid of the farm, by the time a cover crop was planted.

Introduction and Background:

For decades, subirrigation (seepage) irrigation has been the predominant irrigation practice for potato production in Florida. In seepage irrigation the water table is managed according to a target water table level to irrigate the crop. This type of irrigation involves pumping a large volume of groundwater to maintain a high water table. With seepage irrigation, the field water table is controlled at a depth just below the plant root zone by either adding or removing water from the field depending on the target-level water table. As a result, in many agricultural production areas in the state, seepage management results in excessive water to raise the field water table, which frequently results in water and nutrient/fertilizer loss by deep drainage and

runoff. In addition, a high water table increases the risk of flooding and crop losses during rainy periods which are common to the state. Potato production is extremely sensitive to soil water availability and depletion of more than 50% of the total available soil water during the growing period results in lower yields. The water use of potatoes typically ranges between 13 and 19 in/season (SJRWMD, 1990, 1996; Smajstrla et al. 2000), but small variations from optimum seasonal water application have the potential to decrease potato yield (Shock et al, 1998). Therefore, growers tend to be extremely conservative in their irrigation techniques and the trend has been to over-irrigate in potato production. One potential method to increase irrigation water use efficiency is to improve irrigation scheduling. Soil moisture sensors (to monitor soil moisture in the root zone) and piezometers (to monitor water table levels) configured with wireless communication can provide reliable information to support the irrigation management, potentially reducing the volume of irrigation water required to maintain potato production.

Completion of Deliverable 9b:

Deliverable 9b – Provide a final report documenting the completion of land clearing, land leveling, well drilling, pump station installation, irrigation system installation, and drainage system installation for the 15 acres.

This deliverable 9b report provides a final account of the development of the 15.2 acre field at the Hastings Agricultural Experimental Station. Due to delays associated with drilling a well and providing power to the new electric pump in this field (explained in this report), irrigation and drainage was only provided to the field until May of 2012

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The Experimental Station of Florida Partnership for Water, Agriculture & Community Sustainability at Hastings has 15.2 acres located north of the farm office. Although the original vegetation (above-ground and partial tree stumps) was removed in 2002, the area has not been used for cultivation. Since then, the area has been mowed periodically.

Figure 1 shows the layout of the potato production areas after the development of the area as well as the location of the well, irrigation and drainage system components. The area has been subdivided into 4 production sections (or cells); three production cells of 4.3 acres and a fourth

cell of 2.3 acres. Each 4.3 acre cell will be controlled by a single valve (with solenoid) connected to the 6" main.

As soon as the grant was released on 10/17/2011, our operational crew initiated the activities related to the land development. The first step was to rent a large wheel loader with a root rake and root rake the entire 15+ acres. This occurred the first part of November. November was a wet month and so rain delayed forward progress considerably. After the root raking operation, a heavy disc harrow was used to do a very rough leveling job. Again rain and wet soils were a factor, but that job was finished in early December. The delay of the planned activities was due to excessive number of stumps in the area and the rainfall that occurred in November (2.41" of rainfall) and December (3.00" rainfall) of 2011 (Fig. 2). Due to the absence of a main drainage ditch, relative small volumes of rainfall were sufficient to make the area inaccessible (Fig. 3). After the root raking and rough leveling we ran a deep shank subsoiler to pull any small roots and stumps up that might have been missed by the root rake. There were many stumps deep in the ground from an old timber harvest many years ago. Each of these stumps had to be dug out individually using a track hoe. This job progressed slowly but was finished on third week of January (Fig. 4), the dry weather also helped. In January 2012 it rained only 0.28"; therefore it was possible to advance with the clearing operations.

January 30, 2012, we initiated the first stages of land leveling. We used a large 12 ft. box blade to rough fill and cut the dips and rises in the field. This was finished by the end of the first week of February 2012. After that we rayne planed the field, which took three days and prepped the land for the laser leveling the week of February 6th. Laser leveling took approximately five days. Parallel to the laser leveling process, the tail water ditches were dug. Grades were shot to determine the final layout of the drainage ditches. The final stage of laying down the rows using GPS guided equipment was accomplished March 23, 2012 (Fig. 5).

The pipeline materials were delivered on third week of January and work began on the irrigation system pipeline the week of February 6th. A main pipe (6" diameter) of the irrigation system was installed on the west and north side of the field. Irrigation outlets (spigots) were installed on the north side of the field, according to the traditional furrow distribution of the potato production in the area (60 ft spacing between furrows). The outlets have been fitted with solenoid valves for future automation (Fig. 6).

A well drilling permit was obtained at St. Johns River Water Management District (SJRWMD) on September 2011. The District authorized a maximum of 32.80 million gallons a year (mgy) of groundwater from Floridian aquifer for irrigation of 36 acres of potatoes and additional 15.93 mgy for irrigation of 36 acres of sorghum or other miscellaneous crops. The bidding process for well drilling ended in December 2011. An eight-inch well was drilled at the southwestern corner of the field (Fig. 7). The well drilling and pump station installation began May 4th and was completed on May 9th. The completed pump station was then tied into the recently finished irrigation system pipeline.

The water retention structures were installed in the tail water ditches the week of May 21st (Fig. 8).

A cover crop of sorghum sudangrass was planted on the field by second week of May 2012; irrigation and drainage to this crop began three weeks after planting. Irrigation to this crop was done via an existing pump station in the perimeter of the field, because the new pump station of the field had not been electrically connected to the existing power pole network of the farm by the time the crop was planted. Once the connection is done, the field will be solely irrigated by its own and new pump station.

In April 2012, soil cores were taken in 32 points in the 15.2 acres of land and send to ARL Soils Laboratory – UF for chemical analysis. The soil was then limed at a rate of 2 metric ton/acre and N-P-K fertilizer (10-10-10) was broadcast at a rate of 1,000 lb/ac. The soil was plowed and tilled and seeds of sorghum sudan grass (typical summer cover in northeast Florida) was sowed in May 2012.



Figure 1. Layout of irrigation and drainage structures on an aerial photograph of the 15.2 acre area at the Experimental Station of Florida Partnership for Water, Agriculture & Community Sustainability at Hastings. (obs. figure not in scale).

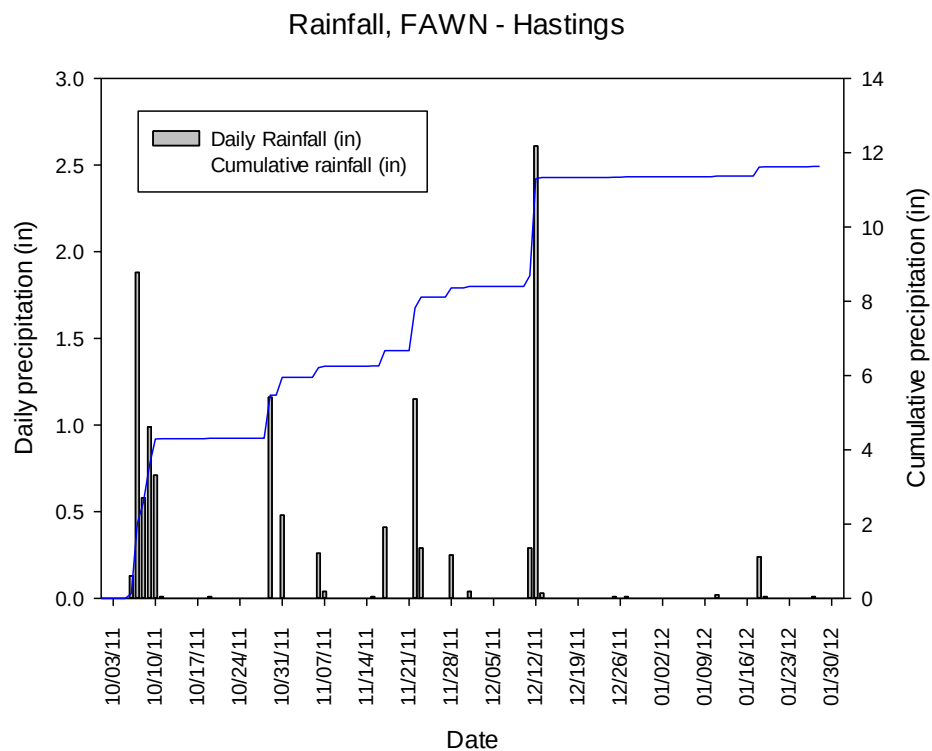


Figure 2. Daily and cumulative precipitation at the Hastings Agricultural Experimental Station. Data available at FAWN (<http://fawn.ifas.ufl.edu/data/reports/>) – Hastings Weather Station. Last access: 01/30/2012).



Figure 3. Overview of the 15.2 acre field at the Hastings Agricultural Experimental Station on Dec. 19, 2011. Detail water ponding on the soil surface 5 days after a rainfall event, occurred between Dec. 11 and 13, 2011 (total of 2.93”).



Figure 4. Overview of the 15.2 acre field at the Hastings Agricultural Experimental Station on Januare 2012.



Figure 5. Rows laid down using GPS guided equipment in early April 2012.



Figure 6. Sample of an irrigation system lateral for each irrigation system block/cell, complete with flow meter and solenoid valve.



Figure 7. Well and pump station on south west corner of field.



Figure 8. Water retention structure installed in tail water ditch and drainage ditch feeding into tail water ditch. Summer cover crop planted in the new research area.