Progress Report or Research Project submitted to the Southern Region Small Fruit Consortium

Title: Horizontal Wells for Irrigation Supply for Blueberries

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Objectives:

1. Determine the potential use of horizontal wells as a water supply system for irrigating blueberries in the Coastal Region of Georgia, and

2. Determine the potential of using horizontal wells as an alternative water supply system for blueberries that does not contribute to salt water intrusion.

Justification:

The problem to be addressed in this project is the limited irrigation water availability resulting from the limited number of deep well permits being issued in the 24 county coastal region of Georgia. This research project will work with farmers and others on a technology for collecting irrigation water for use in the production of crops, specifically blueberries, in the coastal regions of Georgia. Additionally a part of the project will be to research and educate farmers and interested parties on the potential of recycling valuable nutrients used in fruit production. In the coastal region of Georgia and other states, production of agricultural products is limited in some part by the availability of water resources. The Coastal Region of Georgia and neighboring states set on the Upper Floridian Aquifer System, which is a deep and productive aquifer system. However, due to over pumping, salt water has begun to intrude into potable regions of the Upper Floridian Aquifer System being used by citizens along the coast. This intrusion of salt water has forced the Georgia Environmental Protection Division (EPD) of the Department of Natural Resources (DNR) to cap the amount of water removed from the Upper Floridian Aquifer System in the 24 county area of coastal Georgia; thereby, limiting the number of vertical wells that can be drilled. If the amount of water that can be removed from the aquifer is restricted, then the potential for agricultural growth and sustainability is also restricted. With the restriction of groundwater wells, there needs to be alternative technologies by which farmers in the coastal region of Georgia can get water for sustainable production of blueberries and other food and fiber crops. There is the potential to build ponds in this region of Georgia; however, the geology of the region limits the locations and use of ponds due to the underlying sands and required need for sealing materials to be imported.

Horizontal wells were originally developed as far back as the late 1920's to 1930's for the removal of water from landslide prone areas in California and the extraction of oil from selected strata (Society of Petroleum Engineers, 2004; Welchert and Freeman, 1973). Typical applications for the use of horizontal wells includes exploitation of thin oil-rim reservoirs, avoidance of drawdown-related problems such as water/gas coning in the oil industry (Society of Petroleum Engineers, 2004), environmental remediation, water management (Park and Zhan, 2003) and the tapping of water bearing strata in rangeland areas of the arid west (Welchert and Freeman, 1973). This research and education project will adapt and use the advantages of horizontal wells to collect surficial aquifer water for the use in irrigating blueberries in two of the coastal counties in Georgia.

Horizontal wells would be an alternative water supply method in the 24 county Coastal Region of Georgia where the permitting of vertical well and the geological uncertainty of constructing irrigation ponds is restrictive. The horizontal well would also be an alternative water supply that would tap the surficial aquifer system that would not contribute to the salt water intrusion problems associated with over pumping the Upper Floridian Aquifer System. Additionally the use of horizontal wells would allow the farmer to potentially recycle nutrients in blueberry production systems.

This research and education project will use the horizontal well on blueberry farms in Brantley and Ware counties Georgia. With the restriction on vertical well development this project is proposing to research the potential of using horizontal wells to supply required and needed irrigation water to blueberry operations.

The use of horizontal wells has a couple of advantages that apply to this region of Georgia and the United States. These include: 1) horizontal wells are priced comparably with vertical wells, 2) irrigation water can be obtained from surficial aquifers that will not contribute to salt water intrusion, 3) They should not fall under the restriction of well permitting, 4) they allow recycling of nutrients, 5) surficial water would be better for blueberry production, and 6) energy costs are reduced.

Typical costs of horizontal wells are $25-30 per linear foot as compared to $ 20-25 per linear foot for vertical wells (Middleton Drilling Company, personal contact, 2005)Even at a seemingly more expensive well system, the horizontal wells can be useful and should pay for themselves in increased production. This is especially true if the farming operation is restricted on irrigation water or is not allowed to drill a well for irrigation water. The restriction of vertical well permits in the 24 county coastal region of Georgia could prevent the development of a water supply wells for crop production, thereby making the wells affordable. The ability to get irrigation water from a surficial aquifer in the Coastal Region of Georgia would allow a permit to be issued, if required, also it would allow a farmer to produce a crop in a region suitable for the production of blueberries and like crops. The collection of irrigation water from surficial aquifers will also prevent the farming operation from contributing to the problem of salt water intrusion in to the Upper Floridian Aquifer System.

The horizontal well will also allow the farming operation to capture and recycle nutrients thereby reducing the costs associated with the purchase of nutrients to replace ones that have leached past the root zone. The use of horizontal wells will also reduce energy costs of operating the water supply system though a reduced horsepower pump. Horizontal wells are placed typically at 20-30 feet below ground surface verses hundreds of feet below ground surface for deep-vertical wells. This water available in surficial aquifer systems, especially under current blueberry operations will have a pH that is closer to that required for improved production of blueberries. Water collected from deep wells may have high bicarbonate concentrations which has adverse affects on blueberry production. These are increased pH reduces the availability of iron (Fe) and zinc (Zn) for plant uptake, it increases the pH of the soil thereby reducing the health of the plant since blueberries like an acidic soil. The presence of bicarbonates in the irrigation water also affects the root system of the plant and leaves a residue on the leaves. All of these effects of high bicarbonate in irrigation water reduces the productivity of the plant and likewise the sustainability of the farming operation. The last benefit of the horizontal well is that the distance from the surface to the well is small so a smaller horsepower pump is required and an associated smaller requirement for energy.

The benefits listed and described above have substantial relevance to making a farm using a horizontal well system sustainable. The benefits associated with the horizontal well itself contribute to sustainability, but the ability to get water for production will add to sustainability. Additionally, the use of such a water supply system will not adversely affect other aspects of making the farming operation sustainable.

Matter fact, it may make the farming operation more sustainable by reducing nutrient costs associated with production of a crop.

Methodologies:

Horizontal wells will be used in this research project to meet the conditions of the first objective listed above, by adapting the technology of the oil industry to provide a reliable water supply. The length of the horizontal well is practically unlimited and is only limited by the property lines of the farm. This however can be increased by installing multiple and lateral lines if required. The installation of horizontal wells will draw water from a geological layer that is typically homogenous and has similar flow patterns thereby reducing the drawdown problems associated with vertical wells. The installation of horizontal wells under farming operations will also allow the recycling and reuse of otherwise loss nutrients. This recovery of nutrients has a two-fold benefit, first the cost of purchasing nutrients will be reduced and the potential of polluting nearby streams will be reduced.

The second objective will be met by the use of horizontal wells by not contributing to the drawdown effects of vertical wells in deep aquifer systems. This system of wells for water supply uses surficial aquifer systems and never comes in contact with the aquifer systems connected to the areas of the Floridian Aquifer System directly impacted by the salt water intrusion issues. To demonstrate this aspect of the horizontal well, potentiometers may be installed to demonstrate that the drawdown of the aquifer system is not a problem as is with the vertical well systems.

Results:

To date there have been five piezeometers installed at the site to have a horizontal well installed. Three piezeometers were installed at a depth of 25 feet (deep wells) with the use of a truck mounted auger (owned and operated by NRCS). The two additional piezeometers were installed at a depth of 12 feet (shallow wells). Water samples have been collected from the shallow wells over a period of 8 months with very low levels of nitrate (average 0.78 ppm) and phosphate (average 0.18 ppm). Both of these results are expected in that the land where the wells are located is in a newly planted blueberry patch (1 year growth) and little fertilizer has been applied. The nitrate level is below natural levels and the phosphorous level is most likely associated with the conversion of the land from a wooded area to a tilled area. The deep wells are being established. This means that we are in the process of purging the water and clay in order to get clean water samples for analysis.

This winter the purging will be completed and the analysis of the groundwater will begin as well as the determination of the groundwater table elevation. Also, plans have been made to visit with users of horizontal wells in Florida to inquire about pumping rates, pump sizes, lengths, maintenance requirements, and any other lessons learned.

Conclusions:

Part of the funds acquired from SRSFC are planned to be used in conjunction with other funds to allow the researchers to install a larger haorizontal well top provide additional water for the blueberry farmer. These funds have not been made available, but

as soon as they are, the horizontal wells will be installed based on the groundwater elevations measured from the piezeometers.

Impact Statement
There is no Impact Statement at this time.

Citation(s) for any publications arising from the project

Hawkins, G.L., B. Boland, J. Jacobs, G. Krewer. 2006. Horizontal wells: What are they, How do they work and How would they benefit us? Proceedings of the 10th annual North American Blueberry Research and Extension Workers Conference held at the University of Georgia Conference Center, Tifton Ga, June 4-8, 2006, D. S. NeSmith, ed.

Poster presented at the 2006 Georgia Association of County Agricultural Agents annual meeting.