AGRICULTURAL WATER USE IN GEORGIA:
MONITORING RESULTS FROM AG. WATER PUMPING

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ABSTRACT

Results from three years of agricultural water use monitoring are presented for the state of Georgia. The Ag. Water Pumping program, with statistically valid sampling of all water withdrawals, indicates that between 10.8 and 5.8 inches of water were applied "on the average" depending on the region of the state and the year (1999 to 2001). Since all three of these years have designated drought distinctions, agricultural water use was not as high as might have been projected.

INTRODUCTION

The following paper presents results (to date) of the Ag. Water PUMPING (Agricultural Water: Potential Use and Management Program IN Georgia, see: www.AgWaterPumping.net) monitoring program. Since Georgia does not currently have a requirement for agricultural water users to report their use, Ag. Water PUMPING was designed to address this shortfall. With over 21,000 permitted withdrawals, it was not feasible five years ago to require all permitted users to report their water use (cost, personnel, and political constraints). Ag. Water PUMPING was instituted to monitor a representative sample (2%) of all agricultural withdrawals. Wheeler et al. (2002) described how this program was developed and the process used to collect data.

METHODS

The methods for this study have also been described by Wheeler et al. (2002). Preliminary data and procedures were discussed by Thomas et al. (2001), Houser et al. (2001), and Thomas et al. (1999). The main goal of this paper is to present and consolidate the results. The partitioning of agricultural region in the state of Georgia has a strong bearing on the way results are to be presented. The current tri-state water war between Georgia, Alabama, and Florida associated with waters within the Chattahoochee, Flint, and Apalachicola Rivers created a "southwestern" division in our data set. Basically, we separated the southwest region based on surface and ground water that is directly associated with the Flint River

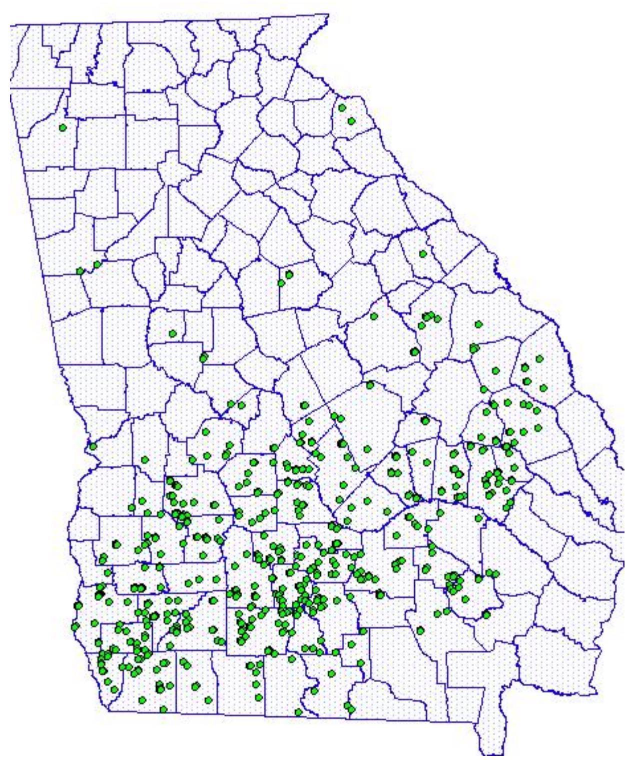

Figure 1. Distribution of monitoring sites within Ag. Water PUMPING.

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(called the Flint Basin). We are also dealing with significant salt water intrusion issues along the coast. A 23 county region was designated (tier 1 to tier 3 counties) to address the salt water intrusion problem. The surface and ground water withdrawals within these counties are associated with the Coastal Zone region of the state. Both of these two regions are currently under a moratorium for new agricultural permits (ground water). Surface water withdrawal permits are still allowed in the coastal region, but most of the easily-accessible (and economical) surface water resource withdrawals are already in place.

The central part of the state is currently not facing moratoriums or lawsuits. This area was the last to be instrumented by our project, and has a greater percentage of surface water withdrawals. This region (everything else in south Georgia) is designated as the Central Coastal Plain (CP) region of Georgia. Additional agricultural withdrawal permits are being monitored in North Georgia, but the total number of permits and the number of monitored sites makes these withdrawals somewhat negligible in the overall analysis.

Presentation of agricultural water use data can be in a variety of different formats. The one chosen for this paper is "inches". Inches of water use implies "acre-inches" or water that has been applied over a particular crop area to that average depth. One of the largest constraints in presenting agricultural water use data in Georgia is the lack of definitive data on exactly how many permitted withdrawals are actually in use, and whether all withdrawals are represented in the permit data base. The Cooperative Extension Service of the University of Georgia has performed an irrigation survey periodically over the past two decades. The most recent irrigation survey (2000) indicated that there were over 1.5 million acres of irrigated acreage in the state of Georgia (Harrison, 2001). At the same time the permit data base indicated over 2.0 million acres of agricultural irrigation, and the National Agricultural Statistics Service (NASS) indicated less than 750,000 irrigated acres in the state of Georgia (Hook et al., 2001) . Choosing the correct irrigated land area has a major bearing on total withdrawals due to agriculture.

RESULTS

General results from monitoring program are described in Table 1 from each of the three basins for the three years of actual monitoring. Installation (*) years are so designated. Only those sites with complete irrigation records were used in the installation years. It is important to note that south Georgia has been in a drought since 1998. Rainfall has been quite a bit less than normal during this period. These results are averaged across all monitoring sites and crops within the particular regions. The total acreage associated with the indicated water use values are also indicated.

Table 1. Average Irrigation Water Use from Ag. Water Pumping.

<u>Total Monitored Irrigation in Year 1999:</u>	
Flint Basin:	10.82* in.
Central CP:	-
Coastal Zone:	7.63* in.
<u>Total Monitored Irrigation in Year 2000:</u>	
Flint Basin:	10.17 in. on 19,920 ac
Central CP:	7.26* in.
Coastal Zone:	7.48 in. on 5,130 ac
<u>Total Monitored Irrigation in Year 2001:</u>	
Flint Basin:	7.51 in. on 19,830 ac
Central CP:	5.80 in. on 16,070 ac
Coastal Zone:	6.56 in. on 5,740 ac

Questions immediately arise as to the "reason" for the differences across the regions of the state. Obviously, the first reason is the differential distribution of rainfall during the growing season. Afternoon thundershowers and frontal systems create localized rainfall patterns with potential for drastic differences in rainfall across the state. Obviously, rainfall variations are likely to be a prime reason for the differing irrigation values. Figure 2 indicates rainfall characteristics for selected months in the year 2000. At least four weather stations within the Georgia Agricultural Environmental Monitoring Network (Hoogenboom, 2001) were used to create the rainfall values in each region of the state. The long-term average values are based on 60+ years of historical records from the Tifton, Georgia weather station. Long-term average rainfall is quite consistent across the southern portion of the state. The rainfall values are "total" rainfall, not "effective" rainfall. In some months, rainfall totals were achieved by a couple of large rainfall events. Much of this rainfall was likely to runoff or go to deep percolation (and not be available for plant use). September was the only month with widely varying rainfall amounts across south Georgia as compared to the other months.

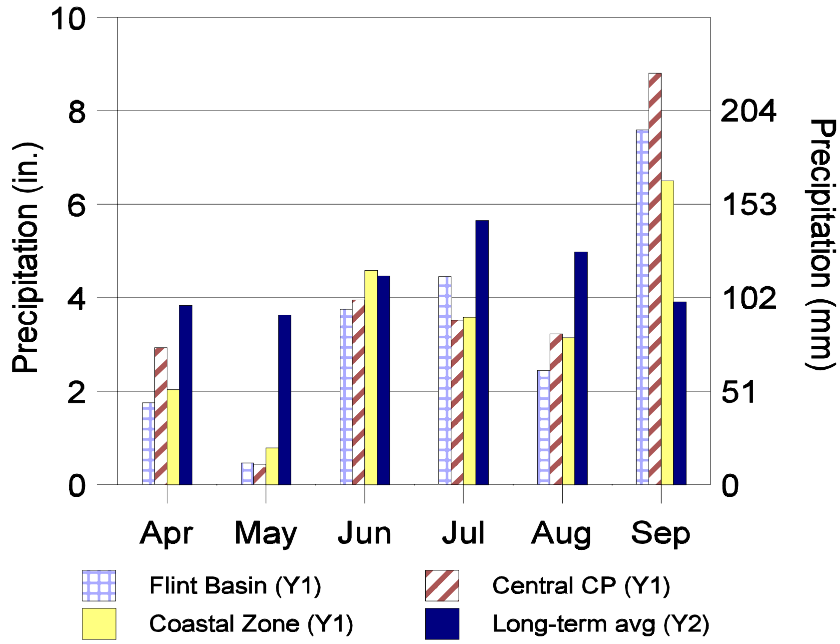

Figure 2. Year 2000 rainfall distribution during the primary growing season for most agricultural crops.

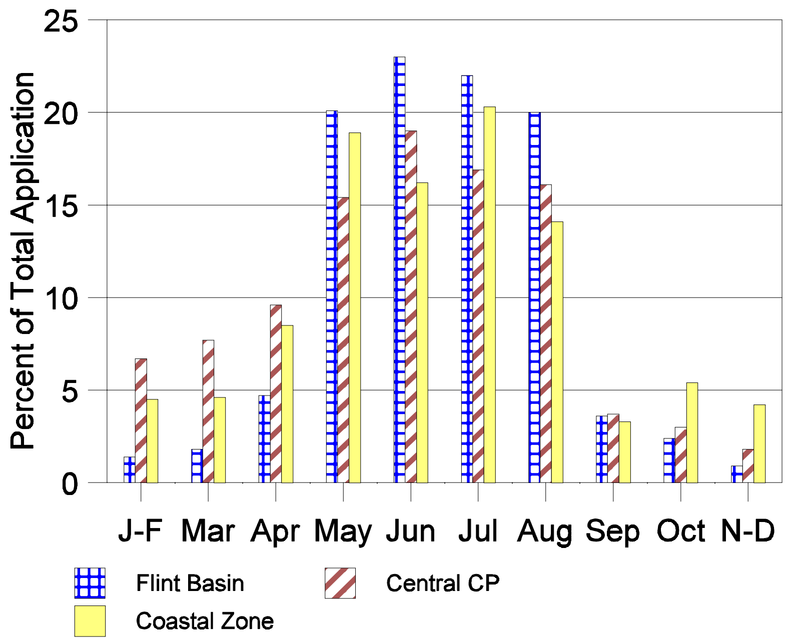

Figure 3. Year 2000 irrigation water use as distributed across the year.

The year 2000 was defined as a drought year. However, only a few months showed evidence of severe drought conditions. Figure 3 illustrates the distribution of the irrigation during 2000. In a typical year, irrigation applications are highest in the months of May through August because most summer crops are being irrigated sometime during those months. The percent of total application indicated in the figure is a representation of when irrigation applications occurred throughout the year. For the Flint Basin, most irrigation was during the summer months. For the other regions, irrigation applications were distributed throughout the year. For the Coastal Zone, the

Vidalia onion season has irrigation applications during the winter months. Based on the information shown in Table 1, more water was applied in the Flint Basin in 2000. This may have been a result of "water availability" rather than "water need".

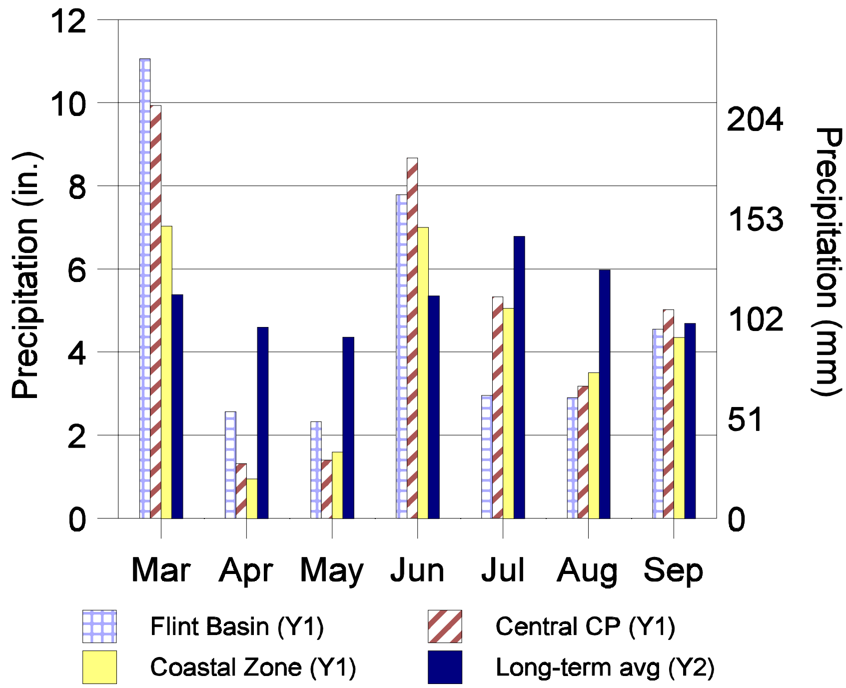

Figure 4. Year 2001 rainfall distributions across the southern portion of Georgia.

Figure 4 describes rainfall characteristics in 2001, also described as a drought year. Average rainfall conditions for all locations across South Georgia (based on at least 5 raingages in each region from the Georgia Automated Environmental Monitoring Network (GAEMN; www.Georgiaweather.net) indicated lower than normal rainfall for April, May, July and August. Also, rainfall in the Flint Basin was quite a bit lower than normal and lower than other regions in July.

Irrigation applications reflected the differences in rainfall. The greatest amount of water was being applied during July in the Flint Basin. July is one month when most major row crops are being irrigated (corn, cotton, and peanut). The year 2001 was also the first year that the installation of monitoring sites was complete for Ag. Water Pumping.

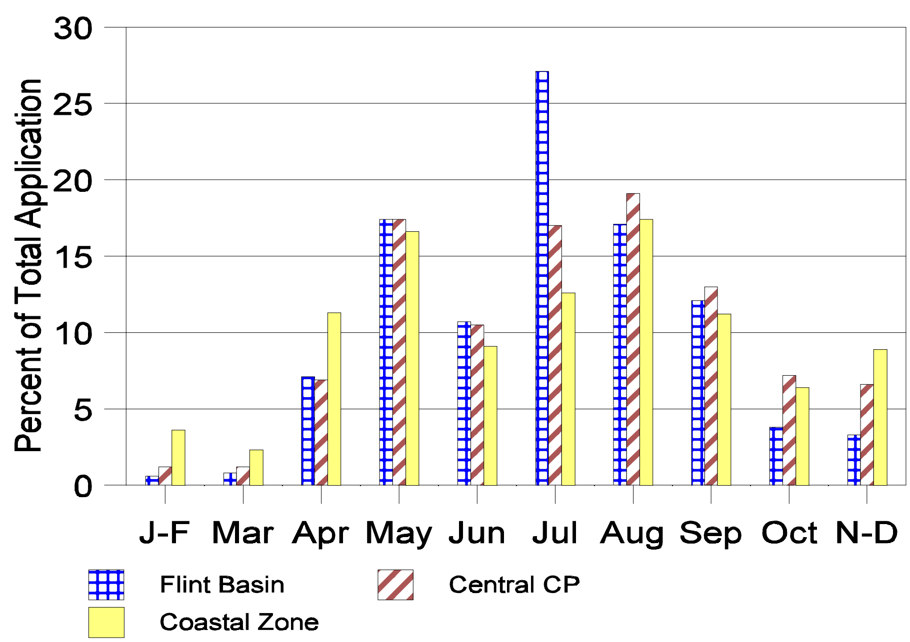

Figure 5. Year 2001 irrigation water use throughout the year.

It is important to realize the impact and benefit of rainfall during the growing season. Although drought conditions were evident, total irrigation amounts were not significantly high. Projections by the Georgia Environmental Protection Division indicate "that during a drought year, farmers could be using more than 17 inches" (Rehis, 2002). That does not seem to be the case in the statistically valid results of the Ag. Water Pumping program.

One other way to describe the irrigation data is to compare results between 2000 to 2001. Consistent trends in irrigation water use can help with general water management decisions. Figures 6-8 describe the 2000 and 2001 irrigation characteristics for the Flint Basin, Central Coastal Plain, and the Coastal Zone, respectively. The Central Coastal Plain and Coastal Zone results indicate that general water use trends cannot be assumed from year to year. In all three areas, more systems were operating in the first part of 2000 as compared to the first part of 2001. In addition, more systems were operating in the later part of 2001 as compared to the later part of 2000. Additional research on effective rainfall, water supply availability, cropping patterns, and the decision process used by farmers when irrigating, is required to fully understand why irrigation patterns differ from year to year. Some of that data is available in the data base associated with the Ag. Water Pumping program, however, we may not be able to answer all questions with the information available.

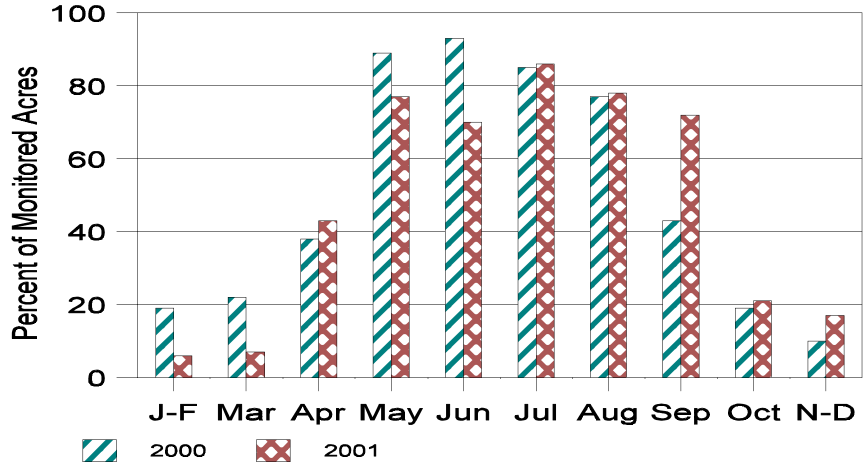

Figure 6. Percentage of monitored acres irrigated in the Flint Basin by month for each year.

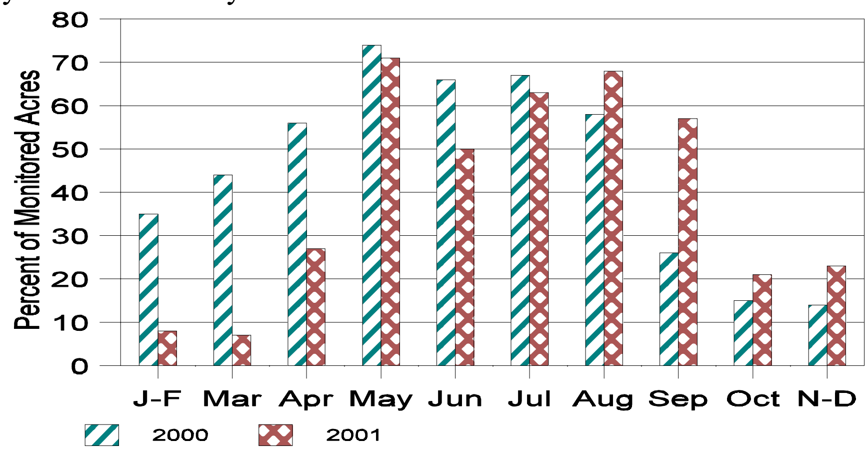

Figure 7. Percentage of monitored acres irrigated in the Central CP by month for each year

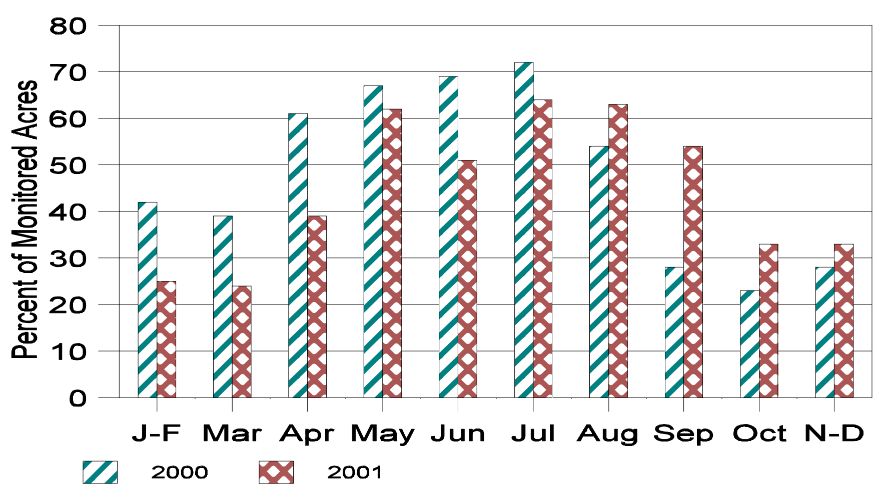

Figure 8. Percentage of monitored acres irrigated in the Coastal Zone by month for each year

<u>Why are farmers using less water than may be projected?</u>

There are many factors that may influence the decision by farmers to use less water. One reason is the inability of many irrigation systems to actually apply that much water during a crop growth period (2 to 3 months). Some irrigation systems have limited water supplies (surface withdrawal permits), thus water must be strategically placed during critical crop growth periods for maximum potential benefit. The rate of return on added water (cost of water versus expected crop yield benefits) is another reason why farmers may not be using as much water. One other factor that influences water application amounts is scheduling approaches. Many different approaches have been suggested and encouraged to help farmers determine crop water needs and when to irrigate. Unfortunately, scheduling remains a significant need, especially for cotton. The University of Georgia introduced the EASY Pan as a way to help farmers schedule both cotton and peanut irrigation (Thomas et al, 2001; Thomas et al., 2002). The unit was designed to require little maintenance and time by the farmer during the growing season. Other options that are being evaluated include simple computer models and irrigation decision support systems.

CONCLUSIONS

Farmers are using a significant amount of water for irrigation in Georgia. Using an estimated 1.6 million acres of irrigated land, farmers used on the average between 0.7 and 1.3 bgd (billion gallons per day) from 1999 to 2001, depending on their location in the state (based on the average 5.8 to 10.8 inches applied). Rainfall provides some contribution to the irrigation water needs, however, total rainfall does not explain all variations associated with "when" water is used. The Ag. Water Pumping program is providing a statistically-valid indication of agricultural water use. Since rainfall variability, crop rotations, water supply availability, scheduling approaches, and economic viability all contribute to farmer decisions about irrigation, the need for effective understanding about "why farmers use the water the way they do" is very important. However, agricultural water use during drought years may not be as severe as has been projected by some agencies.

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