IRRIGATION MANAGEMENT STRATEGIES IN GEORGIA

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Abstract. Water use distribution across space, time, and crops is important to irrigation management strategies. A survey of Georgia irrigators was administered to collects information about crop choices and irrigated acreages allocation under different irrigation management strategies, factors affecting the decision to irrigate, farmers' interest in open-access information, and decision support programs. Results indicate that the choice of crops affects the irrigation management strategy applied. Weather, soil, plant visual condition, germination, and growth stage are the most cited factors affecting the decision to turn on the pump. The quantity of irrigated water is typically measured by visual inspection and general experience. Farmers expressed considerable interest in accessing information relevant to their crop choice, acreage allocation, and irrigation strategies through the internet

INTRODUCTION

While agriculture is often cited as the primary consumptive use of water in Georgia, there is considerable uncertainty about how that consumption is distributed across space, time, and crops. Crop choice decisions, affected by economic variables and available input (land, labor, technology, etc.), will influence the use of water resources in agricultural production. Farm-level water management decisions involve consideration of crop water requirements, irrigation technology, economic factors, and weather variables. Together these factors influence the timing and amount of water applied to crops and consumed by the agricultural sector.

As the pressure on Georgia's water resources increases – from weather-related phenomena, demographic changes, inter-state obligations, and ecological protection – a greater understanding of how water-use decisions are made within the agricultural community will facilitate the development of water policies that can protect and enhance the economic integrity of the agricultural sector in the state. This paper presents initial results of a survey of Georgia irrigators. The survey is focused on the determinants of farmers' crop choice, intra-seasonal water management decisions, and inter-seasonal irrigation technology adjustments. The survey also addresses farmer interest in open-access information and decision-support programs delivered by the University of Georgia via the internet.

DATA

A stratified random sample of 195 farmers in Georgia was drawn for the survey. Attempts were made to contact the farmers in this sample by telephone in June, 2004. Of the 195 farmers in the sample, thirty-seven percent (72 farmers) completed the survey. Another 8 percent (16 farmers) had retired from farming. The remaining fifty-five percent were either unavailable (69 farmers) or refused to complete the survey (38 farmers).

The questionnaire contained two sections. The first section focused on information related to the 2004 growing season. This included planted crop acreage by irrigation technology, as well as factors affecting the timing and amount of water applied during irrigation events. The second section focused on more general management decisions such as factors affecting crop choice, farmer information sources, and farmer interest in open-access information and decision support programs.

RESULTS

Crop Acreage Planted

Tables 1 through 3 present data on the acreage of crops planted under center pivot, microsprinklers, and drip irrigation, respectively. Peanuts, cotton, and corn cover by far the largest irrigated acreage within the sample, nearly all under center pivot. Vegetables and pecans are the only crops that have a substantial share of acreage under more than one type of irrigation system. For vegetables, 71% of the acres are under center pivot, but the remaining 29% are grown with drip irrigation. For pecans, the acreage is more evenly split, with 44% under microsprinklers and 56% under drip systems.

Table 1: Crop Acreage Planted Under Center Pivot

Crop	Count	Total Pivots	Total Acres	Acres per Pivots
Peanut	42	225.5	13249	58.8
Cotton	41	285.5	26701	93.5
Corn	32	147	8659	58.9
Vegetable	12	22	1232	56.0
Tobacco	7	13	601.1	46.2
Soybean	5	8	910	113.8
Fruit	2	15	1000	66.7
Sod	2	7	215	30.7
Wheat	1	1	30	30.0

Table 2: Crop Acreage Planted Under Microsprinkler Irrigation Systems

Crop	Count	Total Micro Systems	Total Acres	Acres per Pivots
Peanut	1	1	10.0	10.0
Corn	1	1	80.0	80.0
Pecan	5	10	1345.0	134.5
Tobacco	2	2	95.0	47.5
Container-Grown Woody Ornamentals	1	1	8.0	8.0

Table 3: Crop Acreage Planted Under Drip Irrigation Systems

Crop	Count	Total Drip Systems	Total Acres	Acres per Pivots
Peanut	1	1	33	33.0
Vegetable	4	20	500	25.0
Pecan	4	22	1716	78.0
Fruit	1	1	1	1.0

Planting Dates and Irrigation Events

Planting dates were recorded for each crop and irrigation technology. With the exception of cabbage (listed as a vegetable), none of the annual crops in the survey were planted before March 1, 2004; all planting within the sample was completed by June 21, 2004. There was considerable variation in the number of acres planted per day for the corresponding crops. Table 4 presents information on the mean and standard deviation of the acres planted per day by crop.

Many respondents completed planting within a single day. Others, however, took longer. On average, respondents took one to two weeks to complete planting. At the high end, respondents took up to two months to complete planting.

Table 4: Days to Complete Planting

Crop	Planting Date		Acres Planted per day	
	Earliest Start	Latest End	Mean	Std.Dev.
Corn	1-Mar	10-May	84.9	193.2
Cotton	1-Apr	5-Jun	49.7	47.3
Peanut	10-Apr	31-May	39.6	46.3
Soybean	25-May	21-Jun	23.2	17.0
Tobacco	25-Mar	25-Apr	7.5	1.3
Vegetable*	1-Mar	10-May	13.8	15.8

* Some cabbage was planted Dec. 1, 2003, and Jan. 20, 2004

Table 5: Irrigation Events per Day Since Planting

Crop	Mean #Events Per Day	Max #Events Per Day	Std.Dev. #Events Per Day	%Planted with Other Crops
Corn	0.08	0.18	0.04	19
Cotton	0.05	0.27	0.06	26
Fruit	0.04	0.09	0.05	0
Peanut	0.03	0.20	0.04	24
Soybean	0.00	0.00	0.00	20
Tobacco	0.08	0.20	0.10	20
Vegetable	0.30	0.78	0.30	61

Table 5 presents information on the irrigation events for each crop between the beginning of planting and the date the respondent answered the questionnaire. Due to the late planting of soybeans, none of the respondents had irrigated their crop at the time of the interview.

The questionnaire also asked whether more than one crop was planted under a given irrigation system. In other words, whether turning on the pump for that system meant that more than one crop would be watered. The big row crops were planted alone 75-80% of the time. When they were planted with other crops, the decision to turn on the pump for the row crops was generally driven by the water needs of corn and tobacco. Vegetables were planted in mixed groupings more than 60% of the time. For vegetables, the key crops in the water application decision were squash and cucumber.

Factors Affecting the Decision to Irrigate

The irrigation decision is really a two-stage decision. Initially, the farmer must decide whether or not to irrigate. Secondly, the quantity of water used must be determined. In the survey, farmers were asked to identify the factors affecting both stages of this decision. With respect to the first stage, a variety of factors were reported, with farmers often citing more than one factor for a given crop and technology. Factors affecting the decision to turn on the pump are reported in Table 6.

In addition to the factors listed in Table 6, a few farmers also indicated irrigation events were associated with herbicide and fertilizer applications, calendar schedules, and decision-support tools like Irrigator Pro.

Factors Affecting Water Application Rates

Farmers were asked to indicate what factors they consider in determining the quantity of water to apply during a given irrigation event. The responses were highly dependent on crop and irrigation technology. The most frequently cited factors were visual inspection of the crop, general experience, recent weather conditions, and soil conditions within the field. Table 7 reports the results.

Table 6: Factors Affecting the Decision to Irrigate

Crop	Irrigation Technology	Count	# of Respondents				
			Weather	Soil	Plant*	Germination	Growth Stage
Peanut	Pivots	44	12	5	10	8	7
	Micro	1				1	
Cotton	Pivots	43	11	7	9	16	4
Corn	Pivots	35	22	9	10	4	3
	Micro	1		1			
Vegetable	Pivots	14	7	3	5	2	5
	Drip	8		8			
Tobacco	Pivots	8	4	3	1		
	Micro	2		2	1		
Pecan	Micro	4	4	1			
	Drip	3	1	1	1		
Soybean	Pivots	5		1	1	2	
Sod	Pivots	2	2		1		
Fruit	Pivots	2	1	1	1		

*Plant here means the farmers make the decision by plant's visual appearance such as wilting.

Table 7: Factors Affecting Irrigation Application Rates

Crop	Tech	Count	# of Respondents				
			Visual Inspection	General Experience	Recent Weather	Soil Conditions	Tension Meters
Peanut	Pivots	44	8	7	3	2	
	Micro	1		1			
Cotton	Pivots	43	14	5	2	3	
Corn	Pivots	35	12	5	6	4	2
	Micro	1	1				
Vegetable	Pivots	14	8	1			2
	Drip	8		3		1	4
Tobacco	Pivots	8	4	1	1	1	
	Micro	2	1	2		1	
Soybean	Pivots	5	1			1	
Pecan	Micro	4		1	3	2	
	Drip	3		1			
Fruit	Pivot	2	2	1	1		
Sod	Pivot	2	1	1			
	Drip	1	1				

In addition to the factors listed in Table 7, a few farmers used rain gauges, evaporation pans, drip pans, and herbicide application requirements to determine the application rate for an irrigation event. Surprisingly, only 2 respondents indicated extension service recommendations were an important factor in deciding the amount of water to apply.

Use of Expert Program Systems for Irrigation Management

The survey also asked farmers about irrigation-related information on the internet. In particular, farmers were asked whether they would use the internet to make irrigation decisions if a single web site were to provide information on crop water needs, futures prices and input cost estimates, and weather forecasts. They were also asked if they currently use any decision-support programs to make irrigation management decisions, and whether or not they would consider using a decision-support program available on the internet through the University of Georgia website. The responses to these questions are summarized in Table 8.

Table 8: Current Use of Decision-Support Programs and Future Use of Internet-based Information and Support Programs

	Yes		No		Maybe	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Information from Single Website	46	63.9	26	36.1		
Currently Use Decision-Support Program	10	13.7	63	86.3		
Consider Using a Future UGA Decision-Support Program via Internet	50	69.4	20	27.8	2	2.8

SUMMARY AND CONCLUSIONS

The results of the survey indicate that the farmers utilize different irrigation technologies for different crops. In Georgia, peanut, cotton, and corn cover by far the largest irrigated acreage within the sample, nearly all under center pivot. The irrigation efficiencies also vary greatly from one crop to another. In general, the irrigation technique used and the characteristics of crops are considered when the quantity of irrigated water is determined.

Irrigation strategies, including the decision to turn on the pump and how much water to apply, are affected by a lot of factors. These factors influence the respondents' decisions to varying degrees. Weather, soil, plant visual condition, germination, and growth stage are the most cited factors affecting the decision to irrigate. Visual inspection, general experience, recent weather, and soil conditions are the most cited factors affecting the decision of water application rates. This result indicates that many farmers still rely on visual inspection and general experience to determine the quantity of irrigation water. More accurate measures of soil moisture content and crop water needs in determining application rates could increase irrigation efficiency.

Finally, farmers would be interested in accessing the internet to make irrigation decision if a single web site, such as a future UGA decision-support program , were to provide information on crop water needs, futures prices and input cost estimates, and weather forecasts, although few respondents are already using a decision-support program. Lack of computer literacy and access to internet resources are the primary reasons some farmers are not interested in web-based decision-support programs. This also impedes the adoption of computer-based tools for formulating production and business plans. There are still some farmers that need to be guided through the computer adoption process in their farm business operations and relevant, reliable, timely information must be delivered with greater efficiency. This, in turn, will assist farmers in making production and irrigation decisions that are consistent with their own goals, and thereby enhance the welfare of the greater farming community.