

Utah Hay and Forage Grower Preferred Drought Management Strategies

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Introduction

Hay and forage production plays a vital role in Utah's economy as hay sales generated \$267 million in 2019 (UDAF, 2020), not including the value of hay grown and used within the same operation. However, agricultural production puts large demands on water resources as agriculture consumes 80% of all water in the United States (USDA ERS, 2019). Thus, climate change impacts and drought, especially in drought-prone areas of the southwest U.S., pose a threat to productivity in the agricultural sector, as well as the economies of rural and tribal communities.

Utah is currently the third driest state in the United States, as 65% of the state experienced abnormally dry conditions from 2000 to 2019 (NIDIS, 2019a). In 2018 and 2019, 38% of the state experienced severe drought (NIDIS, 2019b). Severe drought is connected to heavy pasture and crop losses as well as water shortages requiring restrictions on use, especially in the late summer months. Hence, persistent drought often leads to severe economic consequences in rural communities (Lal et al., 2012; Howitt et al., 2017).

Considering the large contribution agricultural production makes to Utah's economy, approx. 2% of GDP (BEA, 2019), agricultural adaption to drought in order to maintain food and feed production is critical. This fact sheet examines the preferred drought management strategies of hay/forage growers and how their preferences change depending on drought severity and expected crop yields.

Study Overview and Data

The aim of the study conducted by Utah State University described here was to determine agricultural producer preferences for drought management strategies and how their preferences shift in response to varying levels of drought conditions and expected crop yields. Data was collected at producer meetings and online in 2019 for three groups of producers: hay/forage growers, fresh produce growers, and livestock producers. This fact sheet provides an overview of the results for the hay/forage growers.

Grower Characteristics

Among hay/forage growers who participated in the study, 35 respondents answered important study questions and were included in the final sample. Most of these participants farm on 101-300 acres of land (37%), grow hay as their primary crop (46%), sell their products using direct sales outlets (65%), and use wheel line irrigation systems (43%). Also, 67% of respondents have previously used cover crops and 82% have used manure applications, which are water saving technologies. Finally, 29% of the respondents considered crop losses of 40-59% large, while 29% of the respondents were more sensitive to crop losses, considering losses under 40% large. Table 1 provides an overview of grower characteristics.

Table 1. Characteristics of Hay/Forage Growers

Characteristic	Category	Count	% share
Primary operator gender	Male	32	91%
	Female	3	9%
Primary sales outlet	Direct	22	65%
	Wholesale	11	32%
	Other	1	3%
Acres farmed	0-100	12	34%
	101-300	13	37%
	301-1000	5	14%
	>1000	5	14%
Primary output	Hay	16	46%
	Livestock	14	40%
	Other	5	14%
Primary irrigation system	Flood	6	17%
	Pivot	14	40%
	Wheel	15	43%
Cover crops used previously	Yes	22	67%
	No	11	33%
Manure applications used previously	Yes	28	82%
	No	6	18%
What is a large % of crop loss to you?	80-99%	2	6%
	60-79%	12	35%
	40-59%	10	29%
	20-39%	9	26%
	<20%	1	3%
Number of respondents	-	35	100%

Note: Sum of responses per characteristic may not add up to 35 (some answers missing).

Preferred Strategies

First, hay/forage growers were asked to select their most preferred drought management strategy from a list of options, assuming a drought that could cause large crop losses but not specifying a specific yield or amount of crop loss for each strategy. The results in Table 2 (panel A) show that most hay/forage growers (33%) preferred to switch to a low water-use crop/variety. Adoption of a water saving technology, such as cover crops and manure applications, were most preferred by 27% of the hay/forage growers, while transitioning to a more efficient irrigation system was most preferred by 24%. The smallest share of the sampled hay/forage growers (15%) selected moving out of farming as their most preferred strategy.

Growers were then asked whether or not they would adopt a specific drought management strategy, while assuming a drought that could cause large crop losses, but also specifying the expected yield or amount of the crop harvested (40%, 60%, and 80% for each strategy) if they adopt the strategy. The three offered strategies were switching to a low water-use crop/variety, adopting a water-saving technology, and switching to a more efficient irrigation system. Grower responses were used to estimate the minimum level of harvested crop (yield) that growers require in order to adopt a specific strategy and determine the preference among the

strategies (see Table 2, panel B). Lower values represent higher willingness to adopt the strategy (and higher preference) and vice versa.

As shown, growers are willing to switch to a more efficient irrigation system if they can harvest at least 38.5% of their crop, which is the lowest among the three strategies, making it the most preferred strategy. Growers need to harvest at least 46.7% of their crop in order to adopt a water saving technology and 49.9% to switch to a low water-use crop/variety. The strategy rankings change depending on whether information about crop yields under each strategy were provided (see Table 2). In summary, growers change their preferences for a drought management strategy depending on the amount of the crop harvested, which in turn depends on drought severity.

Table 2. Grower Preferences for Drought Management Strategies

Strategy	A. No crop yield information provided		B. Crop yield information provided	
	Rank	% of respondents ¹	Rank	Crop harvested ²
Switch to a low water-use crop/variety	1	33%	3	49.9***
Adopt a water saving technology	2	27%	2	46.7***
Switch to a more water efficient irrigation system	3	24%	1	38.5%*
Move out of farming/fallow land	4	15%	-	-

Notes: *** and * denote significance at 1% and 10% level, respectively.

¹ Percentages represent share of respondents who selected given strategy as most preferred.

² Percentages represent required minimum % of crop harvested. Lower value indicates that the strategy is more preferred.

Grower preferences for the drought management strategies also differ across grower subgroups. Table 3 reports minimum yields by percentage required within each grower subgroup for a given strategy. Statistically significant differences between the subgroups are highlighted in bold font.

Table 3. Preferences for Drought Management Strategies by Grower Subgroups

Characteristic	Category	Switch to a more efficient irrigation system	Adopt a water-saving technology	Switch to a low water-use crop
Primary operator gender	Male	38.2%	48.6%	52.4%
	Female	41.1%	27.0%	24.2%
Primary sales outlet	Direct	42.0%	49.4%	57.0%
	Other	36.3%	44.5%	41.1%
Acres farmed	0-100 acres	21.4%	53.6%	48.5%
	101-300 acres	55.7%	35.4%	56.2%
	301-1000 acres	24.8%	58.4%	54.1%
	> 1000 acres	49.1%	47.3%	29.3%
Primary output	Hay	53.5%	53.8%	60.5%
	Livestock	27.2%	38.5%	48.6%
	Other	22.9%	47.2%	18.0%
	Flood	72.0%	46.9%	63.6%

Primary irrigation system	Pivot	38.3%	44.6%	50.0%
	Wheel line	26.7%	48.7%	44.6%
Cover crops used previously	Yes	30.7%	41.1%	47.4%
	No	37.6%	54.0%	48.4%
Manure applications used previously	Yes	46.5%	47.6%	55.3%
	No	37.8%	37.4%	14.1%
Large % of crop loss	0-39%	36.3%	40.6%	46.9%
	40-59%	31.7%	49.3%	45.1%
	60-99%	49.0%	48.5%	57.5%

Notes: Bold font indicates that the minimum required percentage yield required to adopt is significantly different between the subgroups within a characteristic.

Those who farm on 101-300 acres, primarily grow hay, use flood irrigation systems, and have used manure applications before are less willing to switch to a more efficient irrigation system, the most preferred strategy when information about crop yields is provided. Adoption of a water-saving technology is preferred more by those who farm on 101-300 acres and those primarily raising livestock. Switching to a low water-use crop, the least preferred strategy overall when information about crop yields is provided, is preferred more by females, those who use sales outlets other than direct, those who farm on more than 1000 acres, those whose primary output is other than hay and livestock, those who use wheel line irrigation systems, and those who have not previously used manure applications.

Finally, hay/forage growers were asked under what conditions they would stop farming. Of the 23 growers that responded, 26% indicated they would cease if there was no water at all, 26% mentioned issues with profitability, production, or market, 17% mentioned multiple year drought/extreme weather conditions, and 9% gave no reason.

Conclusions

Drought conditions would have to be very serious and long-term for hay/forage growers in Utah to exit farming. They are more likely to switch to a low water-use crop/variety as a drought management strategy than adopt a water saving technology or switch to a more water efficient irrigation system, if the crop yield is unknown. However, growers are sensitive to the percentage of expected crop harvested (yield) and associated drought severity since it influenced their willingness to adopt each strategy and caused changes in their preferences. In addition, we find some differences in preferences for the strategies across grower subgroups.

Finally, information about expected yields under each drought management strategy and drought scenario is important to the decision-making process, and thus, growers would benefit greatly from such information. Policies to improve uptake of drought management strategies should target grower preferred options as they are more likely to be successful. Policies which provide incentives such as covering a portion of the costs to implement drought management strategies are also recommended.

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