

# ASSESSING AGRICULTURAL LOSSES FROM DROUGHT

A Joint Project of the Southern Extension Public Affairs Committee, the Southern Extension Marketing Committee, and the Southern Extension Farm Management Committee

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## Assessing Agricultural Losses from Drought

Agricultural Economists at Land Grant universities are frequently called upon to provide estimates of economic losses from natural disasters. These estimates can attract considerable attention for a couple of reasons. First, Extension personnel are a key source of information for the media covering disaster events. Thus, estimates of loss provided by Extension personnel are generally widely reported. Second, and most importantly, damage estimates can be politically sensitive. Policy makers and other stakeholders, at the local, state, and federal levels, will use university-developed damage estimates to justify requests for disaster assistance. Such estimates often serve as the basis for the allocation of public resources to disaster assistance programs. In light of these facts, it is important that Extension economists be equipped to provide damage assessments that are as accurate and objective as possible using data and methods that are both transparent and well-documented.

The purpose of this paper is to provide extension personnel with a guide that will help them to define agricultural losses due to drought – one of the more commonly occurring disaster events contributing to agricultural losses – as completely and as objectively as possible. Toward that end, discussion will focus specifically on the types of losses that should be considered, the sources of price and production data for developing damage estimates, and any data availability and/or quality issues that will affect damage estimates.

### Defining and Valuing Production Losses

#### *Major Row Crops*

##### Sources of Acreage and Yield Data

The process of defining production losses is most straightforward in the case of major row crops. The reason for this is that the U.S. Department of Agriculture National Agricultural Statistics Service (NASS) provides a wealth of information on acreages and yields for these crops (at least at the state level) throughout the production season. Also, crop condition ratings are available throughout the growing season, providing a useful barometer of the extent and severity of any developing drought event – at least in terms of its potential impact on major row crops. These within-season estimates of acreage, yield, and crop progress/condition can be compared to information from past years (e.g., a three to five year average of crop yield or of the percent of a given crop rated as very poor or poor at a particular point in the growing season) to demonstrate the impact that a drought is having on production. Extensive historic acreage, yield, and crop condition/progress data is available from NASS in an online, interactive database (website: [http://www.nass.usda.gov/Data\\_and\\_Statistics/Quick\\_Stats/index.asp#top](http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp#top)).

A number of weekly and monthly NASS reports providing especially useful information in the context of preparing disaster estimates for major row crops are briefly described below:

#### Weekly NASS Reports

##### *Crop Progress*

This report is released weekly (each Monday) throughout the production season. It included estimates of crop progress (e.g., percent planted, percent emerged, percent harvested) at the state level. As the growing season for each crop progresses, it includes a crop condition rating (i.e., percent of the crop in very poor, poor, fair, good, or excellent condition), also at the state level. This report basically covers major field crops and pasture/rangeland only.

Website: [http://www.nass.usda.gov/Publications/National\\_Crop\\_Progress/index.asp](http://www.nass.usda.gov/Publications/National_Crop_Progress/index.asp)

#### *State Crop Weather reports*

Each state NASS office also produces a weekly weather/crop condition summary specific to that state. These reports generally include a brief qualitative description of the past week's weather and crop development along with crop progress and condition reports similar to those found in the national Crop Progress report. State reports generally also include information on at least some fruit, vegetable, and specialty crops of significant to the particular state (e.g., watermelons, blueberries, peanuts, etc.).

Website: [http://www.nass.usda.gov/Publications/State\\_Crop\\_Progress\\_and\\_Condition/index.asp](http://www.nass.usda.gov/Publications/State_Crop_Progress_and_Condition/index.asp)

#### *Weekly Weather and Crop Bulletin*

This report includes much of the same information as the weekly Crop Progress report; however, it includes additional descriptions of the past week's weather in different geographic regions. Also, the crop progress and condition data in this report (released on Tuesday) is final whereas the Crop Progress report information (released on Monday) is considered by NASS to be preliminary. This report also compiles in a single publication each of the descriptive summaries of weather and crop progress/condition from the individual states.

Website: [http://www.nass.usda.gov/Publications/National\\_Crop\\_Progress/index.asp](http://www.nass.usda.gov/Publications/National_Crop_Progress/index.asp)

#### Monthly NASS Reports

##### *Crop Production*

The monthly *Crop Production* report provides the most up-to-date estimates of planted acreage, harvested acreage, and yield available from any source. For this reason, it can be a very useful source of information on losses for field crops, hay, and certain fruits and vegetables. For fall harvested crops, the August report is critical because that report includes yield estimates based on objective yield surveys (as opposed to the primarily trend-line estimates that are reported earlier in the growing season). Acreage and yield estimates are refined and updated in each monthly report as harvest progresses, though final numbers are generally not available until the February following harvest when the annual Crop Values report comes out.

Website: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1046>

While NASS represents a vital source of information for assessing damages to row crops from drought (or any other natural disaster), this data is not without its limitations. For major row crops, NASS data is quite extensive; however, there are undoubtedly situations where data will be required that is simply not available. For example, the only states in the southern region for which grain sorghum yields are estimated in monthly *Crop Production* reports are Arkansas, Oklahoma, and Texas. Similarly, there are a few southern states for which peanut yields are not estimated in the *Crop Production* report.

Another limitation of NASS data with respect to major row crops could arise from the timing of when estimates are released. As noted, the *Crop Production* report begins providing objective yield estimates in August. There may, in some cases, be a need to provide preliminary drought loss estimates before these yield estimates are available.

In the absence of NASS data, a number of other sources of information on crop acreages, yields, and condition are available. These include Extension production specialists and field staff, Department of Agriculture personnel, crop insurance professionals, and private crop consultants. The reality is, however, that most of these sources will be able to provide only subjective estimates based on their own experience, supported by little, if any, objective data. In such cases, the only alternative will be to survey as broadly as possible to develop a consensus estimate of production losses and to report (if possible) a range of estimates reflecting the degree of uncertainty

associated with the estimate for a given crop. In general, the best approach to obtaining loss estimates from relevant professional sources will be to elicit an estimate of the percentage acreage and yield loss. The surveying of relevant production experts may be done informally (e.g., through phone contacts) or formally (e.g., by convening a meeting or distributing written or on-line surveys), depending upon the time available for compiling estimates.

#### Estimating Prices for Valuing Production Losses

In order to assign a value to estimates of production losses, it is necessary to estimate a price for the crop in question. For major row crops, a number of sources of good price estimates are available. The USDA World Agricultural Outlook Board releases a monthly report, World Agricultural Supply and Demand Estimates (WASDE) that includes an estimated marketing year average price for all major row crops except cotton. The marketing year average price (MYA) is a weighted average price reflecting the average price received over the course of the 12-month marketing period beginning at harvest. This is the price that is used by USDA in computing value of production (e.g., as reported in the annual *Crop Values* report). At times, it may be more desirable to attempt to quantify the value of production losses using a harvest time price. In that case, for the major row crops, harvest time futures contract prices (adjusted for average basis at the state or local level) provide the best means of establishing a price.

#### Estimating Economic Damages with Acreage, Yield, and Price Estimates

With respect to row crops, losses will generally be of three major types: acreage abandonment, yield losses, and quality losses. Final abandonment figures can be obtained from NASS's *Crop Production* reports, which give both planted and harvested acreage. Some amount of abandonment is to be expected in any year. Historic data from NASS can be used to determine how abandonment in a disaster year compares to historic average abandonment. Estimates of harvested acreage for most row crops are published by NASS beginning with the August *Crop Production* report. These abandonment reflected in these numbers can be compared with historic averages to provide an estimate of the disaster impact. If an abandonment estimate is required prior to the availability of harvested acreage estimates in the *Crop Production* report, expert opinion on the percent of abandonment, which can then be applied to planted acres figures, may be the only alternative. In the case of an early-season drought that actually prevents planting, it may be possible to use the March *Prospective Plantings* acreage estimates from NASS along with subsequent estimates of actual planting to determine any acreage losses due to the drought.

With respect to yields, the best methodology for obtaining loss estimates will again depend upon the time of year that estimates are being made. With the availability of the August *Crop Production* report, state level yields based on objective yield survey data are available. These can be compared to trend line yields to provide an estimate of loss. If earlier estimates are required, expert opinion of the average percentage yield loss can be applied to trend line yields to provide loss estimates. If estimates of yield loss are required at the county level, relying on expert opinion will likely be the only alternative.

Once acreage and yield loss figures are estimated, the loss can be valued using the expected market price, as previously discussed. It should be clearly noted that this results in an estimate of the gross value of the loss and is not the same as an estimate of reduced cash receipts or net income. This estimate also in no way reflects the impact on producer receipts of any crop insurance indemnities, though on major row crops, crop insurance coverage is widely available and widely used at at least the catastrophic (50%) coverage level.

The third major category of loss, quality degradation, is very difficult to quantify. With respect to row crop losses from drought, quality losses are not likely to be a major source of loss. Quality

losses may arise indirectly, through insect or disease pressure that is exacerbated by the drought-stressed conditions of the growing crop. At any rate, assigning a value to such losses and ascribing that value to drought conditions will be difficult to do objectively.

### ***Fruits, Vegetables, and Other Specialty Crops***

#### *Sources of Acreage and Yield Data*

Obtaining acreage and yield data on fruits, vegetables and other specialty crops is generally much more difficult than for major row crops. Objective public data is not as readily available for these crops, though NASS does provide information for selected crops and locations. Key NASS reports related to fruits, vegetables, and other specialty crops are described below:

#### *Vegetables*

This report is released 5 times each year (January, April, July, September, and October) and includes state level estimates of harvested acreage and yield for selected vegetable and melon crops. Only major producing states are covered in this report, however.

Website: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1177>

#### *Non-Citrus Fruits and Nuts*

This report is published in January and July and includes information on acreages and yields for non-citrus fruits, nuts, and berries (e.g., blueberries, strawberries, blackberries). Data is not reported for all states, however, so this report may not be of use in obtaining information for a state with a limited acreage (e.g., strawberries in Mississippi).

Website: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1113>

#### *Floriculture Crops*

This report is released annually in April and includes information on the area in production for things like, cut flowers, bedding plants, and ornamental potted plants. Due to the nature of production for these types of plants (i.e., in greenhouses or irrigated beds) losses from drought are not likely to be common.

Website: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1072>

#### *Crop Production*

The monthly *Crop Production* report also includes information on a number of specialty crops such as dry edible beans, pecans, citrus fruits, and sugar cane. The report does include quite a bit of state level data for major producing states; however, most states in the southern region do not fit that description for many of the specialty crops covered by this report.

Website: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1046>

For many minor crops, the only source of data on production losses will be expert opinion. Since most fruit, vegetable, and specialty crops are not covered by government programs or even by crop insurance products, Extension and state department of agriculture personnel are likely to be the best source of information on acreages, potential yields, and yield and/or quality losses. As noted above, such information will necessarily be subjective in nature, so it is advisable to report a range of values for damage estimates if at all possible.

#### *Estimating Prices for Valuing Production Losses*

Determining a realistic price for valuing production losses on fruits, vegetables, and specialty crops presents a greater challenge than for major row crops. Obviously, futures market prices are not available as a forecast of prices. For some crops, the USDA reports noted above will provide

something analogous to the marketing year average price for row crops; however, many crops and states are not covered by these reports.

Current prices on many fruit and vegetable crops are reported by USDA Agricultural Marketing Service (AMS). AMS reports on wholesale prices in major regional terminal markets on a weekly basis. For the southern region, relevant markets reported by AMS include Atlanta, Baltimore, St. Louis, Dallas, and Miami. Wholesale prices provide a useful benchmark for valuing production losses. Historic market data can be used to develop seasonal indices that can be used to estimate a price for any particular month if, for example, a harvest time price forecast is needed. The primary limitation of using wholesale prices from AMS is that many fruit and vegetable producers in the South do not market their produce through a large terminal market. Many producers rely on other marketing methods such as pick-your-own, roadside stands, and farmers' markets. Prices through such outlets can vary substantially from major-market wholesale prices. Public information on these prices is not generally available, however. Thus, in developing estimates of the economic value of production losses, one must generally either use a reported wholesale price or use a more subjective price determined in consultation with the relevant experts (e.g., from Extension, department of agriculture, or trade groups). In either case, the selected approach and its limitations should be clearly disclosed and, as noted above regarding production losses, a range of prices should be reported if possible.

### ***Livestock***

Livestock losses from drought will most likely be confined to forage-based production systems. Thus loss estimates will focus primarily on beef and dairy operations. Estimating the value of production losses from drought for cattle (in fact for any commodity with a continuous production system) is considerably more difficult than for annually produced crops. Losses in beef and dairy systems will potentially be of both a short-run and a long-run variety. Short-run (or single-season) losses will include the value of things like lost forage production (on both hay and grazing land), reduced weaning weights, reduced milk production, and increased mortality. Long run (or multi-year) losses will include things like the cost of having to reestablish pastures and reduced meat or milk production in subsequent years due to forced sales in the drought year.

#### **Single-Season Losses**

Single-season forage losses are the most straightforward to estimate. In fact, estimating forage production losses is much like estimating losses in row crop operations. With respect to hay, harvested acreage and yield estimates at the state level are available from NASS in the monthly *Crop Production* report. Deviations of acreage and yield from historic averages provide a very good estimate of state level hay losses. Grazing losses are more difficult to quantify, but a yield loss of roughly equal percentage to the hay loss is reasonable.<sup>1</sup> Census of Agriculture data on pasture acreage along with assumptions about "normal" forage production and grazing utilization rates can then be used to obtain an estimate of grazing loss. For assigning a value to forage losses, hay prices reported by AMS are readily available, though regional rather than state-level prices may be the best available.

Animal production losses are much more difficult to quantify objectively. With respect to beef operations, public data on weaning weights or rates of gain at the state level do not exist. State-level total pounds of production are reported each April in the *Meat Animals – Production, Disposition, and Income* report from NASS, but this information is of very limited value for several

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<sup>1</sup> This may undervalue forage losses somewhat due to nutritional differences between growing forage and dried forage.

reasons. First, it is not particularly timely, coming out in April summarizing the preceding year. Second, production is influenced by cyclical effects that make it more difficult to use historic averages to establish a benchmark from which to measure losses. Finally, in drought years, pounds of production will often increase as producers cull more cows and retain fewer heifers than in a normal year. Because of these difficulties, it may be more desirable to quantify drought impacts in terms of the increased costs of maintaining "normal" production with purchased feeds. This will necessarily involve a number of key assumptions and should be done with the input of relevant production experts.

#### Multi-year Losses

Multi-year losses from drought will derive from both the forage base and the cattle herd itself. Forage losses result from the need to reestablish stands in the wake of a drought event. Again, public information on this issue will be basically non-existent. Forage production specialists should be able to provide at least a subjective estimate of the aggregate percentage stand loss for the most affected types of forage. Enterprise budgets are widely available, then, for estimating the cost of reestablishing that forage.

Multi-year animal losses are again rather difficult to quantify objectively, but may be expected to arise from two different sources. First, heat and/or nutritional stress related to drought conditions could reduce conception rates, leading to a smaller calf crop in the following year. Second, forced sales of breeding stock will result in costs associated with herd rebuilding and/or lost income from a reduced calf crop. A rather large number of assumptions will be required to address either of these issues. For example, how much would one expect conception rates to be reduced by any particular drought event? How much will it cost to replace animals that were culled over and above the normal culling rate? How much of that cost was offset by the salvage value of the animals sold? (One might reasonably assume that culls were sold on a depressed market, whereas replacements would be purchased on a stronger market, but that is not necessarily the case.) There will be little, if any, objective data for justifying any of these assumptions; therefore, considerable sensitivity analysis on these points (as well as detailed disclosure of all assumptions) is called for in developing these estimates.

#### ***Disseminating Information***

In the wake of any disaster event, there will be considerable public interest in estimates of the economic value of agricultural losses. These estimates will be reported (generally without question, context, or discussion of underlying assumptions) by the media and will likely be used by policy makers to develop disaster assistance plans and programs. If disaster estimates are prepared in a timely fashion, their dissemination will take little effort, as interested parties in the press and the policy arena will actively seek out and distribute any publicly-provided estimates. A bigger concern is that university-provided disaster estimates not be disseminated haphazardly. Preliminary estimates should be reviewed by departmental, college, and (perhaps, depending on the level of interest in and sensitivity on the subject) university administration so that all relevant personnel are aware of, first, what the estimates are and, second, the process by which they were obtained. It will very likely be useful to publish damage estimates in some form that can be easily referenced (e.g., departmental working paper, Extension fact sheet, Experiment Station bulletin, etc.). Time may not permit the review, publication, and dissemination of an official publication before estimates have to be made public; but a subsequent publication could still be useful to make the university's "official" damage estimates an accessible part of the public record.

### ***Summary and Conclusions***

The preparation and dissemination of estimates of economic losses due to drought or other natural disaster can be a difficult and politically sensitive undertaking. For some crops, good, objective public data is readily available, making the process of estimating losses relatively easy. For other crops, due to data limitations and/or the nature of the relevant production systems, the estimation of losses will be very subjective. The key points for extension personnel to keep in mind in formulating damage estimates are 1) document all data and procedures as completely as possible, 2) clearly indicate and justify, to the degree possible all critical assumptions, 3) estimate and report a range of estimates reflecting the degree of uncertainty regarding the data available for any particular commodity, 4) allow administration to review all estimates prior to their public release.