

**United States
Department of
Agriculture**



National
Agricultural
Statistics Service

and

Office of the Chief
Economist, World
Agricultural Outlook
Board

Miscellaneous
Publication
No. 1554

Understanding USDA Crop Forecasts

Understanding Crop Statistics. Frederic A. Vogel, National Agricultural Statistics Service, and Gerald A. Bange, World Agricultural Outlook Board, Office of the Chief Economist, U.S. Department of Agriculture. Miscellaneous Publication No. 1554.

Abstract

Each month, the U.S. Department of Agriculture publishes statistics and related information about crop production in the United States and the world. Several USDA agencies are responsible for preparing these statistics. The methodology used by the National Agricultural Statistics Service to prepare the crop forecasts is described to give the user of these data a better understanding of the strengths and weaknesses. This is followed by a similar description of the world agriculture supply and demand estimates prepared by the World Agricultural Outlook Board.

Preface

The crop supply and demand estimates prepared by the USDA are crucial to both policy makers in government and people involved in making decisions about marketing and investing.

In today's information age, the statistical methods described within this paper provide the benchmark against which all other data sources are compared. The agencies involved have a solid record of objectivity and ability to meet established report dates. This objectivity is preserved because it is USDA policy to make it so. The Secretary of Agriculture's office is briefed about the results only after the final results have been completed and prepared for distribution to the public.

The security of the data before release is fiercely defended with extraordinary efforts to ensure there is no premature disclosure of any of the information.

Hopefully this report will answer the many questions often raised about how the estimates of production, supply and demand are generated.

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Introduction

Each month, the U.S. Department of Agriculture (USDA) publishes crop supply and demand estimates for the Nation and the world. These estimates are used as benchmarks in the marketplace because of their comprehensive nature, objectivity, and timeliness. The statistics that USDA releases affect decisions made by farmers, businesses, and governments, by defining the fundamental conditions in commodity markets. When using USDA statistics, it is helpful to understand the estimating procedures used and the nature and limitations of crop estimates.

Several agencies within USDA are responsible for preparing crop statistics. The National Agricultural Statistics Service (NASS) forecasts U.S. crop production based on data collected from farm operations and field observations. Forecasts for each crop season begin with a winter wheat and rye seedings report in early January followed by a March report that gives a first look at what farmers intend to plant. This is followed in late June by a report of the acreage actually planted. Monthly yield and production forecasts begin in May for winter wheat, in July for spring wheat and other small grains, and in August for other spring-planted crops, concluding with estimates of actual production at the end of the harvesting season. NASS also conducts quarterly surveys of grain and soybeans stored on and off farms.

The World Agricultural Outlook Board (WAOB) coordinates an interagency process that prepares monthly forecasts of supply and demand for major crops, both for the United States and the world, and follows a balance-sheet approach to account for supplies and utilization. The major components of the supply and demand balance sheet are beginning stocks, production, domestic use, trade, and end-of-season carryout stocks. Whereas forecasts of U.S. crop production and estimates of U.S. stocks on hand are independently prepared by NASS, U.S. and foreign supply and demand forecasts are developed jointly by several USDA agencies.

The NASS *Crop Production* report and the *World Agricultural Supply and Demand Estimates (WASDE)* report are prepared simultaneously in a secured area and released at 8:30 a.m. Eastern Time between the 9th and 12th day of each month. Joint preparation enables USDA analysts to incorporate the new NASS production forecasts of U.S. crops into supply and demand estimates. These estimates provide an overview for more detailed analyses published by other agencies of USDA, especially the Foreign Agricultural Service (FAS) and the Economic Research Service (ERS). Country-level data published by all USDA agencies must be consistent with the supply and demand numbers released by NASS and WAOB.

USDA strives to provide the agricultural community with estimates that are accurate, objective, reliable, and timely. Security measures are used to prevent leaks of market-sensitive information. The agencies conduct research to improve estimating techniques. The following discussion provides a closer look at how USDA arrives at its estimates, the data sources used, and the policies governing initial reports and revisions.

Preparing NASS Production Forecasts

Crop production forecasts have two components--acres to be harvested and expected yield per acre. For example, preliminary corn and soybean acreage estimates are made using data obtained from a survey of farmers conducted during the first 2 weeks in June. Expected corn and soybean yields are obtained monthly, August through November, from two different types of yield surveys. Data from the yield surveys reflect conditions as of the first of the month, as data are collected during the last week of the previous month and the first 2 or 3 days of the current month.

Crop production forecasts are based on conditions as of the survey reference date and projected assuming normal conditions for the remainder of the season. For example, the assumption of "normal conditions" is that temperatures and precipitation will be at historic averages for the remainder of the season. It is assumed that the first killing frost will occur on the historic average date. The crop maturity and conditions at the reference date are evaluated against the time remaining until the expected frost--if one third of the crop will not reach maturity until the frost date has passed, it is assumed that some frost damage will result. Long-range weather projections are not used as an indicator for final yield.

The reference point for crop forecast surveys is the first of the month, which is also usually close to the mid-point of data collection. Both grower-reported average yields and objective-measurement modeled yields contain a measurable forecast error based on the historic difference between these survey estimates and the final end-of-season yield. The review process followed to develop the monthly yield forecasts involves evaluating the relative ranges of the forecast errors of the grower yields and the objective measurement yields and the degree to which they overlap.

If there is a significant change in conditions between the survey period and the report date such as a killing freeze, serious heat wave, beneficial rains, etc., the primary goal is to provide the most accurate production forecast possible given the available survey data. The official estimate may represent a departure from the survey averages, but still will reflect the current crop conditions within the ranges provided by the data. When NASS states as policy that it is forecasting based on conditions as of the first of the month, it is saying that it will establish yields within the range of the survey estimates.

When forecasting crop yields, NASS does not attempt to predict future weather conditions. Long-range weather forecasts are not used in any forecast models. To the extent that conditions depart from normal, the forecasts also will fluctuate. Procedures used to prepare acreage estimates and yield forecasts are discussed in the following sections.

Base for Acreage Planted and To Be Harvested

The largest single survey NASS conducts each year is the June Agricultural Survey. During the first 2 weeks in June, about 2,400 interviewers contact over 125,000 farmers, either by telephone or in person, to obtain information on crop acreages, grain stocks, and livestock inventories. These producers are asked to report the acreage, by crop, that has either been planted or that they intend to plant, and the acreage they expect to harvest as grain. Data from this survey are used to estimate, among other things, total acres planted to corn, soybeans, and other crops regardless of the intended uses. Preliminary projections of acres to be harvested for grain or soybeans, including seed, are also made using these data. This survey also provides estimates of quantities of grain stored on farms and livestock inventories.

The sample design for this survey utilizes two different sampling frames. The area frame, which is essentially the entire land mass of the United States, ensures complete coverage of the U.S. farm population.

The list frame, a list of known farmers and ranchers, does not provide complete coverage of all farms, but allows the use of more efficient data collection methods.

Sampling from the area frame is a multi-step process. First, all land in each State is classified into land use categories by intensity of cultivation using a variety of map products, satellite imagery, and computer software packages. These land use classifications range from intensively cultivated areas to marginally cultivated grazing areas to urban areas. The land in each use category is then divided into segments ranging from about 1 square mile in cultivated areas to 0.1 square mile in urban areas. This allows intensively cultivated land segments to be selected with a greater frequency than those in less intensively cultivated areas. Segments representing cultivated areas are selected at a rate of about 1 out of 125. Sample segments in land use classifications with decreasing amounts of cultivated land are selected at rates ranging from 1 out of 250 to 1 out of 500.

About 10,000 area segments are selected nationwide for the survey conducted each June. Using maps and aerial photos showing the exact location and boundaries of each sample segment, interviewers locate and interview every operator with land inside the segment boundaries to identify crops planted in each field, and to obtain livestock inventory information, and quantities of grain in storage. A similar survey is conducted in early December which provides a measure of winter wheat acres planted.

Before sampling from the list, each farm is classified by various characteristics such as number of acres by crop. Large farms are sampled at high rates. For example, Illinois farms on the list with over 5,500 acres of cropland, or grain storage capacity exceeding 500,000 bushels, are selected with certainty, as are Iowa farms with over 5,000 acres of cropland. Smaller farms are selected at rates of 1 out of 25 to 50.

About 75,000 farms across the United States are selected from the list to be surveyed during the same time period in June. Farmers on the list sample are asked to provide total acres planted for each crop on all the land they operate, and quantities of grain stored on their operation. Most of the data from this sample are collected by telephone interviewers.

Data from the area and list samples are combined using multiple-frame statistical methodology developed jointly by NASS and Iowa State University, which ensures that all land areas in the United States can be accounted for once and only once. The June Agricultural Survey is subsampled for surveys in July, September, December, and March for the basic livestock inventory, crop production and quarterly stocks estimates.

Generally, estimates of planted acres from the June Agricultural Survey are not changed during the crop season. However, occasionally the planting season runs late and many fields are not yet planted with the intended crops at the time the survey is conducted. When this happens, adjustments to planted acres estimates may be made at the time of the first yield forecast in August. The preliminary projections for harvested acres may also be adjusted using data from the August yield surveys. When significant portions of the crops are not yet planted, during the survey farmers are asked what they intend to plant. Then, in years such as 1993, 1995, and 1996 these farms are re-visited during late July to determine what was actually planted. If necessary, harvested acreage estimates will be revised and published in the August *Crop Production* report.

Yield Forecasts

A subsample of farmers who respond to the list portion of the June Agricultural Survey is selected to provide monthly crop yield projections. This provides a way to screen farmers so that only those currently growing the commodities of interest are contacted during the monthly surveys. This subsample may be supplemented with other known growers randomly selected from the list frame when monthly district level production forecasts are required for some States.

The sampled farmers are asked what they expect their crops to yield before harvest, and actual yields obtained at harvest. All yield data for an individual report are weighted by the farm's crop acres for harvest.

Objective Yield Surveys are conducted monthly in States that contribute most heavily to total U.S. production of corn, soybeans, cotton, and wheat. These surveys provide information for making forecasts and estimates of crop yields based on counts, measurements, and weights obtained from small plots in a random sample of fields.

Sample corn, soybean, cotton, and spring wheat fields are selected from those identified in the area-frame sample portion of the June Agricultural Survey. Winter wheat sample fields are selected from the fall area-frame survey. Observations within each selected field are made in two randomly located plots. Plots include two or three adjacent rows of predetermined length.

Harvested yield can be thought of as biological or gross yield minus harvest loss. Counts, measurements, and other observations from each sample plot are input to statistical models based on historical data to predict final number of fruit and final weight per fruit. A forecast of gross yield is calculated by multiplying these two components together and dividing by land area. Figure 1 shows the forecast variables used to predict the gross yield components for each crop.

Plant characteristics used as prediction variables change as the crop maturity progresses. At an early stage, plant counts may be the only data available for forecasting the number of mature fruit. As the crop matures, actual fruit counts can be used, and weights and measurements of the immature fruit are used to predict final weight per fruit.

Figure 1: Objective Yield Forecast Variables for Number of Fruit and Weight Per Fruit

CROP	Component	Forecast Variable¹
Corn	ears	stalks ears & ear shoots ears with kernels
	ear weight	historic average length over husk kernel row length ear diameter
Soybeans	plants pods per plant	plants mainstem nodes lateral branches blooms, dried flowers & pods pods with beans
	pod weight	historical average pods with beans
Cotton	boll weight	historical average large boll weight
	heads	stalks heads in boot emerged heads
Wheat	head weight	historic average fertile spikelets grains per head
	bolls	squares blooms small bolls large bolls open bolls

¹ Variables measured are determined by stage of maturity.

The same plots are revisited each month until the crop is mature. At that time, the plots are harvested and final counts and weights are obtained. After the entire field has been harvested, the sample field is revisited and two more plots are laid out. The grain left on the ground in these plots is picked up and weighed to provide a measure of harvest loss.

When harvest is complete, the farmers who operate the sample fields are re-contacted to obtain final harvested acres and yield for the sample field.

The estimate of number of soybean pods per acre from the Objective Yield Survey is usually very consistent from month to month and accurate when the bloom period has ended. Record pod counts have been occurring in recent years as a result of a shift to narrower rows. Pod count forecasts usually stabilize with the September survey.

Average pod weights prior to crop maturity are based on historical averages. In normal years, much of the soybean crop has matured by the October survey, so current-year pod weights are used.

Corn objective yield survey forecasts are based on estimates of number of ears and average ear weight. The ear count forecasts are accurate early in the season. When the crop is late developing, the August projection of ears is based on a model using plant population. Historical average ear weights are used until ears are present to measure. Kernel row length models are then used to project ear weight until crop maturity.

Cotton objective yield forecasts also contain two components, number of bolls, and forecasted weight per boll. The boll count model is in effect a growth model that uses current survey counts compared to historic counts of squares, blooms, small and large bolls to forecast open bolls. Each month during the survey visit to each plot, open bolls are picked and sent to a laboratory where they are dried, weighed, and the lint seed ratio determined. When 20 percent of the forecasted number of bolls for the sample plot have been harvested, the current measured boll weights are used for that sample. Otherwise, 5-year historical average boll weights are used.

Identical procedures are used to forecast yields for both winter and spring wheat. Number of head forecasts are based on different models depending upon crop maturity. These models have a considerable forecast error until emerged heads are present to count. Historical average head weights are used until fertile spikelets and actual filled grains are available to be counted.

Potential accuracy of each month's forecast for these crops is dependent on the crop maturity at the time of the forecast and future weather. When maturity lags normal patterns, number of pods, ears, etc., is based on number of plants and fruiting positions rather than actual number of fruit. Thus, when maturity lags, the forecasts become more variable because the expected number of fruit can differ from the final. However, the primary source of forecast error occurs when final end of season fruit weights differ from the historic average because fruit weight cannot be fully determined until crop maturity.

NASS will revise estimates of harvested acres if necessary during the forecast season. Again, the goal is to make the production forecasts as accurate as possible. The production forecasts are based on projecting the acres that will be harvested and the final yield per harvested acre. If acres are lost during the forecast season because of weather or disease problems, those yields drop to zero, the acres are classified as planted but abandoned, and acres for harvest reduced. For this reason, it is possible for the production forecast to be reduced without a corresponding drop in forecast yield per acre. It is also possible for the yield per acre to increase during adverse periods if acres for harvest are abandoned and classified as not for harvest. Data on which to base changes in harvested acres come from the yield forecast surveys when sample fields are taken out of production or the operator reports acres no longer being considered for harvest.

Grain in Storage: Quarterly grain stocks estimates are based on surveys conducted during the first two weeks of December, March, June, and September. Separate surveys are conducted to obtain the on-farm and off-farm estimates. The on-farm stocks survey is integrated with the quarterly agricultural surveys. These producers are asked to provide the total quantities of grain on their operations as of the survey date. This includes all whole grains and oilseeds stored whether for feed, seed, or sale as well as any stored under a Government program.

The off-farm stocks survey is an enumeration of all known commercial grain storage facilities. This includes approximately 12,000 facilities with about 8.50 billion bushels of storage capacity. An effort is made to obtain a report from all facilities. Reports of stock holdings are normally received from operations covering about 90 percent of the capacity. Estimates are made for missing facilities to make the survey complete.

Administrative Data

Considerable data available from other organizations--both private and public--are used to evaluate the accuracy of production estimates and to determine the final estimates. These sources of information become available during the marketing year, but often after the preliminary production estimates are determined. Some examples of administrative data follow.

Acres Planted for Selected Crops. Prior to 1996, farmers who participated in government programs and wished to be eligible for deficiency payments or disaster benefits must have recorded the acres they planted, by crop, with the USDA Farm Service Agency. These data became available at the end of the growing season and provide a measure of the minimum amounts planted. These data affected revisions in acreage estimates if they were above the levels shown by the survey data.

Utilization Data. Information about imports, exports, soybean crush, cotton ginnings, and industrial use become available during the year. These data are used in a balance sheet that starts with carryover stocks from the previous year and the current production estimate to give a measure of total supply. The subtraction of the utilization data at the end of the marketing year from the total supply established at the beginning of the crop year should correspond closely with the ending stocks. If there is a large unexplained difference or residual, the previous year's acreage, yield, and production survey and stocks data are reviewed to determine where revisions within the range of the survey sampling errors can be made to minimize the residual in the balance sheet.

Preparing Supply and Demand Estimates

The process used by USDA to make supply and demand balance sheet estimates differs from that used for NASS crop production forecasts. NASS forecasts, as seen above, are based on surveys of farmers and on examination of crops in the field. Estimating crop production for foreign countries often involves greater subjectivity because objective farm surveys or other ground truth may not be available. And, forecasting how available supplies will be allocated between domestic use, trade, and stocks in more than 100 countries also entails considerable economic analysis and judgment.

Several features of the process used to derive supply and demand estimates help compensate for the paucity of foreign forecast data. All available information sources are compared. USDA's own resources include weather analysis, country reports from our agricultural attaches abroad, and evidence from satellite imagery. In addition, private and public information sources are considered. This broad information base is reviewed by analysts from several agencies who bring diverse expertise and points of view to bear. To arrive at consensus forecasts, alternative assessments of domestic and foreign supply and use are vetted at meetings of Interagency Commodity Estimates Committees convened and chaired by the WAOB. Throughout the growing season and afterwards, estimates are compared with new information on production and utilization, and historical revisions are made as necessary.

The Balance Sheet Concept

USDA supply and demand estimates reflect a full balance sheet for each commodity and country. Separate estimates are made for beginning stocks, imports, and prospective production to determine the total supply of a crop that will be available for the new marketing year. The demand side of the balance sheet reflects domestic use, exports, and ending stocks. Domestic use may be further subdivided to the extent that such data are available from other sources. For example, USDA obtains data on U.S. wheat ground for flour, oilseed crush, and cotton mill use from the Bureau of the Census. It should also be noted that the demand side of the balance sheet may include a category for "residual" or "unaccounted"

disappearance to account for disappearance or usage that cannot be verified or cross-checked against another objective information source.

The balance sheet disciplines individual estimates: total supply must equal domestic use plus exports and ending stocks. Prices tie both sides of the balance sheet together by rationing available supplies between competing uses. Prices also shape planting decisions for the out year, providing a link between current and future years. The process of forecasting price and balance sheet items is a complex one involving the interaction of expert judgment, commodity models, and in-depth research by Department analysts on key domestic and international issues.

This process plays out each month in Interagency Commodity Estimates Committees, where analysts from the World Agricultural Outlook Board, the Economic Research Service, the Foreign Agricultural Service, the Agricultural Marketing Service, and the Farm Service Agency meet to evaluate current forecasts, new data from NASS and other sources, new information on foreign markets from the FAS staff at foreign posts and other sources, and important U.S. policy developments.

Commodity models, together with new research on commodity market issues, provide the framework for assessing this information. For example, committee members use a variety of models developed in the Economic Research Service and the Farm Service Agency to analyze the new crop information available each month. Expert judgment then provides a reality check and evaluation of model results, and has the final say in determining the Departmental estimates.

Critical supply and demand relationships change over time as policies and structure change. A quality Departmental forecasting process requires a strong research program to ensure that understanding of markets keeps up with changing conditions. For example, the 1996 Farm Act has increased the responsiveness of planting decision to changes in market prices. It has also influenced how the market determines prices. USDA analysts are responsible for keeping the Department's information base and models abreast of changing market relationships. Research conducted by ERS is a critical part of the process of maintaining the quality and objectivity of Departmental supply, demand, and price estimates.

Table 1 shows the balance sheet for U.S. soybeans published in the August 12, 1998, *WASDE* report. USDA made several offsetting adjustments in projected soybean supply and demand for 1998/99. On the supply side, both domestic soybean production and beginning-year stocks were lowered 5 million bushels from projections made in July. Production was lowered to reflect new information from NASS's first survey-based forecast of the 1998 crop. Also, the import projection was increased 1 million bushels. Since these three changes reduced projected supply by 9 million bushels, offsetting changes had to be made on the demand side of the balance sheet. Domestic crush was increased 15 million bushels, despite low crush margins, as demand for soybeans by foreign processors diminished. Seed usage was increased 8 million bushels, following a data series revision for 1997/98. Exports were reduced by 25 million, as foreign competition and declining demand lowered prospects abroad. The residual (unexplained) use, was reduced 2 million, in line with historical indications. Finally, ending stocks were lowered 5 million bushels to balance total use with total supply. The small change in ending stocks resulted in no change in the 1998/99 price forecast range.

Table 1. Projected 1998/99 U.S. Soybean and Product Supply and Use ^{1/}

Item	1996/97	1997/98 Estimate	1998/99 Projections	
			July	August
Area			<i>Million acres</i>	
Planted	64.2	70.8	72.7*	72.7
Harvested	63.4	69.9	71.7*	71.6
			<i>Bushels per acre</i>	
Yield	37.6	39.0	39.5*	39.5
			<i>Million bushels</i>	
Beginning stocks	183	131	215	210
Production	2,382	2,727	2,830	2,825
Imports	9	5	5	6
Supply, total	2,575	2,863	3,050	3,041
Crushings	1,436	1,590	1,600	1,615
Exports	882	870	875	850
Seed	79	86	76	84
Residual	47	107 ^{2/}	64	62
Use, total	2,443	2,653	2,615	2,611
Ending stocks	131	210	435	430
			<i>Dollars per bushel</i>	
Avg. farm price ^{3/}	7.35	6.45	4.85-5.85	4.85-5.85

1/ Marketing year beginning September 1 for soybeans. ^{2/} Supply estimates and reported use through May, coupled with USDA's June 1 stocks estimate, indicate an above-average residual. ^{3/} Prices: Soybeans, marketing-year weighted average price received by farmers. * Planted and harvested acres reported in June 30 Acreage report for July. Projected yield based on trends since the mid-1980's.

Source: August 12, 1998 *World Agricultural Supply and Demand Estimates* report, WASDE-341.

Revisions made in Table 1 are reflected in Table 2, Projected 1998/99 World Soybean Supply and Use. However, data now appear in metric tons, the international unit of measure. Table 2 includes adjustments made to foreign supply and demand.

Disposition between various domestic uses, exports, and ending stocks can be affected by indications of changes in many factors. Such signals range from indications of livestock feeding from the NASS *Cattle on Feed* report to news of reduced crop prospects abroad, to regulatory decisions and changing assumptions regarding the production and use of oxygenate fuels. Expected demand shifts between commodities and countries must be anticipated as price relationships change. New developments in economic conditions, government policies, and global politics also can alter prospects on either side of the equation.

Commodity and Country Coverage

USDA publishes separate balance sheets each month for a number of commodities and countries. Grains covered in the *WASDE* report are U.S. and world wheat, coarse grains, corn, and rice; and U.S. feed grains (corn, barley, sorghum, and oats). Oilseed coverage includes U.S. and world soybeans, and world totals for aggregate oilseeds. The report also forecasts U.S. and world cotton supply and demand. In addition, *WASDE* commodity coverage extends to U.S. refined sugar production and use, and to U.S. supply, use, and price prospects for meat, poultry, eggs, and milk.

Table 2. Projected 1998/99 World Soybean Supply and Use ^{1/}

Region	Supply			Use			Ending stocks	
	Beginning stocks	Production	Imports	Domestic		Exports		
				Crush	Total			
<i>Million metric tons</i>								
World ^{2/}	July	19.20	154.04	38.18	128.49	149.46	38.10	23.86
	August	20.11	153.95	37.62	127.64	149.02	37.87	24.78
United States	July	5.85	77.02	0.14	43.54	47.36	23.81	11.83
	August	5.71	76.88	0.16	43.95	47.91	23.13	11.70
Total foreign	July	13.35	77.03	38.04	84.95	102.09	14.29	12.04
	August	14.40	77.08	37.45	83.68	101.11	14.74	13.08
Major exporters ^{3/}	July	10.80	47.40	1.25	34.90	37.60	12.35	9.50
	August	11.85	47.40	1.25	34.40	37.20	12.80	10.50
Argentina	July	6.40	15.00	0.25	13.70	14.50	1.75	5.40
	August	6.65	15.00	0.25	13.50	14.30	2.10	5.50
Brazil	July	4.40	29.50	1.00	20.60	22.40	8.40	4.10
	August	5.20	29.50	1.00	20.30	22.20	8.50	5.00
Major importers ^{4/}	July	1.57	17.94	29.16	34.80	46.30	0.72	1.65
	August	1.57	17.99	28.88	34.30	46.07	0.72	1.65
EU-15	July	0.76	1.84	15.68	15.70	16.89	0.52	0.88
	August	0.76	1.84	15.50	15.50	16.70	0.52	0.88
Japan	July	0.58	0.12	4.70	3.65	4.86	0.00	0.54
	August	0.58	0.12	4.70	3.65	4.86	0.00	0.54
China	July	0.00	14.00	3.70	10.70	17.50	0.20	0.00
	August	0.00	14.00	3.30	10.30	17.10	0.20	0.00

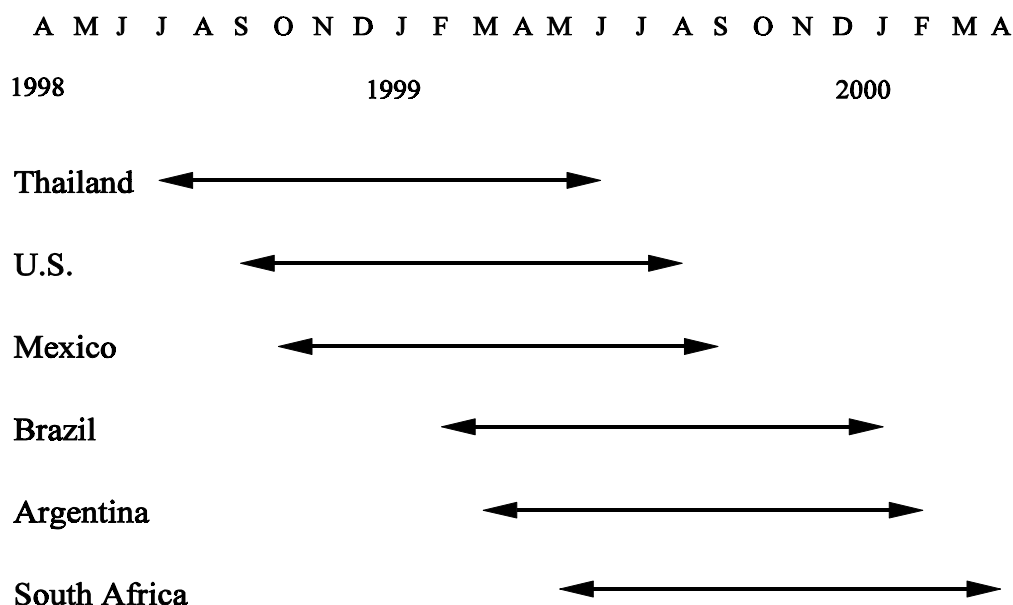
^{1/} Data based on local marketing years except for Argentina and Brazil which are adjusted to an October-September year. ^{2/} World imports and exports may not balance due to differences in local marketing years and to time lags between reported exports and imports. Therefore, world supply may not equal world use. ^{3/} Argentina, Brazil, and Paraguay. ^{4/} Japan, China, European Union (EU), Mexico, and Southeast Asia (includes Indonesia, Malaysia, Philippines, and Thailand).

Source: August 12, 1998 *World Agricultural Supply and Demand Estimates* report, WASDE-341.

This broad commodity coverage allows analysts to reconcile changes among commodity balance sheets. Livestock production, for instance, has implications for corn demand and prices, which in turn has an impact on use of competing feedstuffs, industrial use of corn, and potential exports.

The *WASDE* report publishes estimates for the United States, the world, and selected major countries. For example, soybean supply and use is reported for the world, the United States, Argentina, Brazil, the European Union, Japan, and China. However, in order to estimate world soybean supply and demand, separate balances are prepared for 90 countries. This depth is crucial for obtaining a true global picture of trade prospects and trends. For example, numerous small changes in soybean crop prospects or import needs for relatively minor market participants can negate or augment better-known developments in major countries.

Figure 2. Local Marketing Years for Corn



The monthly release of the *WASDE* report is quickly followed by the publication of more detailed reports from ERS and FAS. These reports are consistent with estimates in the *WASDE* report and receive interagency clearance prior to release. ERS Situation and Outlook reports analyze market prospects and developments, especially for the United States. FAS Circulars report supply and demand at the country level and focus on international trade.

The Forecasting Cycle

Supply and demand estimates are forecast on a marketing-year basis. The marketing year for each crop usually begins with the first month of harvesting, and thus can differ by country or region for the same crop. USDA's marketing year designation for a country may differ from the one used locally, especially where crops such as rice are harvested year around.

Aggregate world supply and demand estimates represent the summation of numerous local marketing years that stretch across many months (see figure 2). For a given year, aggregate world supply and demand estimates represent a concept and not a world total at one point in time. For example, the 1998/99 marketing year for U.S. corn begins on September 1, 1998, and ends August 31, 1999. The *WASDE* report also includes a forecast of 1998/99 corn supply and use for South Africa, where harvest begins in May 1999 and the marketing year for that crop ends in April 2000. Since South Africa competes with us in world corn markets and most of its exports occur shortly after harvest, USDA includes South Africa in the world totals for 1998/99.

The forecasting cycle for the new marketing year begins with projections in the May *WASDE* report. NASS publishes its first estimate of U.S. winter wheat production in May, and spring wheat and other small grains production in July. For spring-planted crops, most notably corn, soybeans, and cotton, May,

June, and July projections of U.S. crop production in the *WASDE* report are based on trend yields and NASS estimates of intended and planted acreage. The assumptions used are spelled out in the footnotes of each table. For both U.S. and foreign estimates, normal weather is assumed for the balance of the growing season. These early-season projections, for both the United States and the world, while necessarily highly tentative, provide a preliminary look at crop supplies and market conditions.

The Consensus Estimating Process

A consensus or “interagency” approach is used to arrive at supply and demand estimates. Consensus forecasts employ “models” of all types, formal and informal. While no single USDA agency or information source dominates the process, each agency contributes based on its relative strength:

- FAS provides information regarding foreign production, use, and trade. FAS gathers global market intelligence from its network of agricultural attaches. This information is assembled and reviewed in FAS Headquarters by commodity and trade analysts and circulated to all participants in the interagency process. Satellite imagery is interpreted to assess foreign crop production potential.
- ERS identifies the most important economic effects and implications for prices, quantity supplied, and quantity demanded. This may include information on such diverse factors as exchange rates, oil prices, the effects of domestic and foreign agricultural policy, and economic growth. ERS analysts routinely interact with analysts in the FAS.
- The Farm Service Agency (FSA) describes the current policy environment and particularly how farmers likely will react to current legislation. FSA employs econometric models, tempered by specialist expertise. This activity involves considerable interaction with ERS.
- The Agricultural Marketing Service (AMS) provides current price and marketing reports for crops and livestock. AMS marketing specialists monitor markets in action on a daily basis and share observations with USDA analysts department wide.
- WAOB coordinates the interagency process, convenes the Interagency Commodity Estimates Committees, and conducts a monthly “lockup” from which the *WASDE* report is released. WAOB also operates the Joint Agricultural Weather Facility, which monitors global weather and assesses its impact on foreign crop conditions and potential yields.

All of these diverse information sources are assimilated each month by Interagency Commodity Estimates Committees. During the overnight lockup meeting, each committee reviews all relevant information and approves the detailed country estimates that are aggregated in world commodity totals.

Foreign Production Estimates

Much of the strength in USDA’s forecasting program derives from the resources available for making country estimates. FAS is the lead agency for the foreign crop estimates that appear in the *WASDE* report. FAS’s considerable information and analytical resources begin with its agricultural attachés, located at U.S. embassies abroad. Attachés survey current growing conditions, evaluate trade prospects, and maintain contact with government and commercial sources.

In Washington, one group of FAS analysts uses attaché reports, weather data, and satellite imagery analysis to propose changes in foreign production estimates for interagency review and clearance. Other analysts separately propose changes in foreign use and trade data. This division of responsibilities

provides a check and balance system to ensure accuracy and integrity of crop production assessment in the supply and demand estimates. This process is designed to assure unbiased forecasts.

Satellite imagery analysis performed by the Production Estimates and Crop Assessment Division of FAS enhances the accuracy and reliability of production forecasts. The imagery is used to monitor the condition and expected yield of foreign crops economically important to the United States: wheat, coarse grains, rice, oilseeds, and cotton. Satellite coverage is global and is adjusted throughout the year to focus on Northern or Southern Hemisphere countries as the season dictates.

Official crop statistics of other nations, where available, are critical in forming current estimates. In practice, not all countries have crop-estimating agencies capable of making reliable, timely, or objective production forecasts. Also, many major producing and trading countries do not publish crop reports until well after the crop has been harvested. In the interim, USDA must rely on the historical record compared with current conditions.

The Joint Agricultural Weather Facility

WAOB manages the Joint Agricultural Weather Facility (JAWF), a combined effort of USDA and the National Oceanographic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. JAWF experts assemble global weather data and assess its impact on crop and livestock production prospects.

NOAA meteorologists on the JAWF staff provide weather information, including data from more than 6,000 stations around the globe, weather-satellite imagery, weather analyses, and interpretations of meteorological information for use in agricultural assessments. Then, agricultural meteorologists from WAOB merge this information with climatological analyses and agronomic data to arrive at the weather's impact on agricultural yields. Assessments are made on a daily basis. Qualitative assessments of domestic and international agricultural weather conditions are published in the *Weekly Weather and Crop Bulletin*, jointly produced by WAOB, NASS, and NOAA.

JAWF's assessments of crop-yield potential are integrated into USDA's monthly foreign production estimates. The evaluation of a crop's yield response is based upon the cumulative effects of weather during crop development. A crop's estimated response to anomalous weather is a function of crop type and growth stages.

Knowledge of historical climate data and production patterns in agricultural regions around the world is critical to JAWF's assessments of weather's impact on crop yields. It is also of great interest to the public. *Major World Crop Areas and Climatic Profiles*, Agriculture Handbook No. 664, provides useful background information, including detailed crop maps, crop calendars, production statistics, and climate data for key producing regions and countries.

Forecast Evaluation

Each month, USDA publishes a scorecard of the accuracy of its U.S. and world commodity forecasts in the *WASDE* report. See table 3 for an example of the reliability of the USDA's August soybean estimates.

Periodically, WAOB conducts an in-depth analysis and evaluation of *WASDE* forecasts. These unpublished assessments focus on the accuracy of monthly estimates starting from the first forecast for a given marketing year in May through the "final" estimate 19 months later. The purpose of this review is to identify forecasting bias, if present, and guard against repetitive errors.

For those interested in reviewing how forecasts change from month to month, WAOB has published a spreadsheet of historical crop, livestock, and dairy estimates from past WASDE reports. The data set includes U.S. forecasts only.

Table 3. Reliability of August Projections of Soybean Supply and Use

Commodity and region	Difference between projected and final estimate, 1981/82-97/98 ^{1/}					
	Average	Average	Difference	Below final	Above final	
SOYBEANS	<i>Percent</i>	<i>Million metric tons</i>		<i>Number of years ^{2/}</i>		
Production						
World	3.0	3.4	-8.7	5.0	9	8
U.S.	4.6	2.5	-6.4	5.7	8	9
Foreign	5.9	3.1	-9.0	6.1	8	9
Exports						
World	5.6	1.6	-3.8	2.7	11	6
U.S.	10.9	2.2	-4.9	5.5	9	8
Foreign	19.4	1.5	-4.0	2.4	8	9
Domestic use						
World	3.3	3.7	-8.8	4.2	10	7
U.S.	4.4	1.6	-3.9	3.5	12	5
Foreign	3.9	2.8	-5.3	4.0	11	6
Ending stocks						
World	13.7	2.3	-6.5	5.5	8	9
U.S.	32.7	2.3	-2.8	6.6	5	12
Foreign	15.6	1.6	-4.3	3.3	10	7

^{1/} Final estimate for 1981/82-96/97 is defined as the first November estimate following the marketing year. The final estimate for 1997/98 is last month's estimate. ^{2/} May not total to 17 if projection was the same as the final estimate.

Source: August 12, 1998, *World Agricultural Supply and Demand Estimates* report, WASDE-341.

Service to Data Users

The value of USDA statistics to data users depends on the ease, speed, and cost of access. NASS and WAOB make special efforts to assure that reports are widely available within a short time of their release. Immediately after the 8:30 ET release time, wire service reporters electronically file their stories on the *Crop Production* and *WASDE* reports from facilities within the lockup area. At the same time, NASS and WAOB quickly post the reports on the Internet. Internet users will find the latest reports and other helpful information on NASS crop and livestock estimates at <http://www.usda.gov/nass>. WAOB information on supply and demand estimates and agricultural weather is located at <http://www.usda.gov/oce/waob>. USDA provides a combined calendar of reports from NASS, WAOB, ERS, and FAS at <http://www.usda.gov/news/calindex.htm>.

In partnership with ERS, NASS and WAOB maintain a central archive of reports and databases on the Internet at <http://usda.mannlib.cornell.edu>.

Reports are also readily available by fax, electronic mail, and in print. Subscribers to printed reports receive rapid service through the ERS-NASS order desk. For more information on these options, contact the customer service numbers below.

USDA's efforts to improve the scope and usefulness of crop estimates are guided by the needs and suggestions of statistics users. Feedback comes from annual "data user" meetings, held to solicit public input and respond to concerns, as well as from calls and correspondence. Each agency has established a single point of contact for customer service to ensure that inquiries, problems, and suggestions receive a prompt response. For NASS customer service, call 1-800-727-9540; to contact WAOB call 202-720-5447.