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Official Production Estimates For Corn And Soybeans: Preparation And Accuracy

By James P. Houck and Daniel Pearson

The official U.S. government forecasts for crop acreage, yield, and production have recently come under close scrutiny and some criticism. In today's world of shortages and uncertainty, the grain markets and grain prices react quickly to any change in the reported level of acreage or upcoming production. Some farmers even say forecasts are used purposely to drive grain prices up or down. Additionally, world grain stocks and production are in a knife-edge balance. So changes in the U.S. grain production outlook—as each growing season unfolds—can change the global food situation from hope to despair and back again within a few weeks.

This issue of *Minnesota Agricultural Economist* describes briefly and unofficially how these crucial acreage and production forecasts are made and released during the crop year. It also examines the accuracy and behavior of monthly production forecasts for corn and soybeans over several recent crop years. Corn and soybeans are emphasized here to limit this article and because these crops are the most important to Minnesota agriculture. However, much of the information applies to other crops and livestock products.

Forming the estimates

The Statistical Reporting Service

The Statistical Reporting Service (SRS) prepares and publishes the official U.S. crop estimates. SRS is the primary fact-collecting and fact-reporting agency of the U.S. Department of Agriculture. SRS is a broad-based, nonpolicymaking organization headquartered in Washington D.C. Today, it consists of a Research Division, a Survey Division, an Estimates Division, 44 State Statistical Offices (SSO's), and the Crop Reporting Board.

The Research Division develops new and improved collecting, estimating, and forecasting methods for agricultural statistics. The Survey Division designs the forms and procedures for the SSOs to use in collecting data by mail or by personal and telephone interviews. The Estimates Division defines and identifies the data to be collected, prescribes the statistical methods to be used, and is the principal contact with data users.

The State Statistical Offices conduct surveys, summarize data, and recommend state and county estimates to the Crop Reporting Board. They also publish information of interest to their own states. For example, the Minnesota Crop and Livestock Reporting Service publishes (among other things) the annual report, *Minnesota Agricultural Statistics.*

There are 44 SSOs; the Massachusetts office serves six New England states, and the Maryland office also serves Delaware. This decentralized approach for making estimates is based on the idea that statisticians in the SSOs: (1) can adapt general procedures to local circumstances; and (2) have better knowledge of regional conditions than people located in Washington, D.C.

The Crop Reporting Board is not a fixed organizational unit. It is convened to officially review and adopt estimates to be published. The board has several permanent members plus five or six commodity specialists selected from the Estimates Division and the SSOs. State representation changes for each report. This is to provide representation from all parts of the country and to assure that statisticians with firsthand knowledge contribute to the final official estimates.

Corn and soybean crop reports

The two types of reports considered here involve acreage and production. For corn and soybeans, the annual cycle of reports begins early in the year with farmers' intentions to plant. These are followed by forecasts of planted acreages, acreages intended for harvest, probable yields, and potential production. Beginning in July for corn and August for soybeans, forecasts of crop production as of the 1st of each month are made through November. Then in January, final estimates of acreage harvested, actual yields, and production are made.

Acreage reports

The first acreage report of each year for spring-seeded crops—such as corn and soybeans—is the Prospective Plantings report. It is now published in January and is revised in March. (The January report began in 1970 and the March report will be replaced by an April report in 1976.) These planting estimates are based on mail surveys; approximately 390,000 farmers receive questionnaires about their spring planting plans. Normally, more than one-fourth of the questionnaires are re-

turned. These are then used to compute acreage indications.

Major nationwide interview surveys using area samples and sophisticated sampling techniques are conducted about June 1 to establish estimates of spring plantings and acreages available for harvest. In addition, questionnaires also are mailed to approximately 470,000 producers. About one-third of these questionnaires normally are returned and used in the computations. The results of these surveys are released in the June acreage report. The estimates of planted acreage, published in the June report, are normally changed very little during the crop season. However, since planting may be incomplete when the survey is taken around June 1, additional information is collected in July from a subgroup of those reporting in June. If a revision is necessary, it is published in August.

Production reports

Forecasts of expected yield and production are issued during the growing season, and *estimates* are issued at season's end. Forecasts and estimates are considered by SRS to be two distinct items. Forecasts relate to an expected future occurrence, such as forecasted crop production as expected before actual harvest. Forecasts assume that weather conditions and insect damage for the remainder of the growing season will be about the same as the average of recent years. Estimates generally refer to the measurement of an accomplished fact, such as actual production estimated after the harvest.

The first forecasts of yield and production are made in July for corn and in August for soybeans. They are then revised monthly until harvest. The monthly forecasts are based on information from both probability surveys and general mail questionnaires. SRS enumerators make actual on-the-spot plant counts and measurements in approximately 3,200 corn fields and 1,700 soybean fields. Statisticians then use these data to forecast average yields. Questionnaires are also sent monthly to about 75,000 individuals who are asked to give their opinions on local crop conditions and expected crop yields. Roughly one-third are returned.

The end-of-year estimates of acreage, yield, and production are reported in the Crop Production Annual Summary published in January after the harvest. By this time, all yield sample plots have been harvested and analyzed. Also, over 800,000 questionnaires are mailed. Farmers report acres planted, acres harvested, and production for each major crop use (such as corn for grain or for silage). They also report acres abandoned or used for other purposes.

Gathering reliable data

When making any kind of survey, it is rarely possible—or even necessary—to get data from everyone. What the total group is like can be inferred from a small, carefully selected portion of the group called a sample. Mail sample surveys are the traditional method of developing agricultural estimates in this country. They are still widely used to provide general information on various agricultural activities. Mail surveys are relatively quick and economical; however, they cannot alone provide all the information needed for accurate estimates. For example, not all farmers in a sample respond to the questionnaire. Those who do may not be representative of the sample or the group. Some respondents may even misreport information. (All individual responses are kept confidential by SRS and are used only to develop estimates.)

To overcome these weaknesses in the general mail survey, SRS has increased its use of probability sampling and interviews. Statistical theory provides a basis for selecting samples so that the chance (probability) of any farm or farmer being in a sample can be computed. Then estimates can be made with much greater precision from relatively small samples.

Still, the basic information sources for crop estimates are individual farmers, no matter how they are selected. So the overall reliability of both forecasts and estimates really depends upon the accuracy with which individuals respond to SRS surveys and interviewers as well as the accuracy of the actual SRS measurements.

Preparing and issuing reports

In December, the contents and the date and hour of release for each scheduled report in the coming year is announced. Work on each report must begin well before the issuing date. This includes survey preparation, approval and printing of questionnaires, issuance of instructions, establishment of training schools for enumerators, and many other activities. In the SSOs, survey data are collected, edited, summarized, analyzed, and then expanded into statewide totals. State statisticians prepare initial indications and transmit them (with supporting materials) for review by the Crop Reporting Board in Washington, D.C.

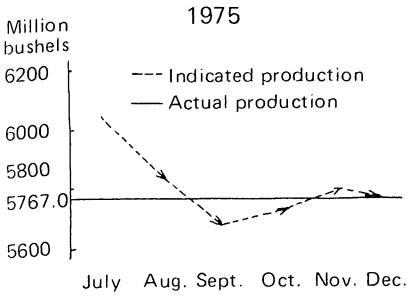
Production estimates for corn and soybeans are sensitive because these crops are heavily traded on the commodity futures markets. Anyone having early access to official estimates would have an obvious advantage in trading. Consequently, strict precautions are taken to prevent leakage of such information before its official release. The reports from the SSOs receive special handling in the mail; upon arrival in Washington, they are placed into a steel box secured by two locks. One key is held in the Office of the Secretary of Agriculture and the other by the Secretary of the Crop Reporting Board.

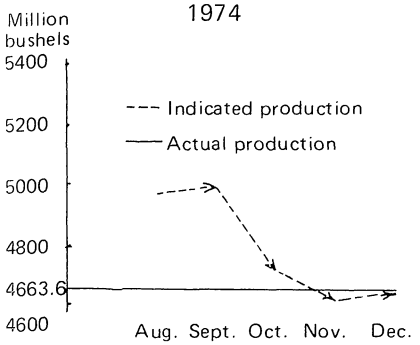
Early in the morning of the scheduled release day, the chairman of the Crop Reporting Board and a representative of the Secretary of Agriculture open the box and remove the state reports. Then, escorted by a guard, they take these reports to the board rooms.

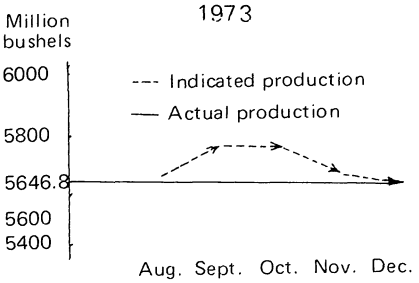
While the final report is being prepared, the office area is isolated and guarded. Doors are locked, window blinds are closed and sealed, and all telephones are disconnected. Food is sent in. Only authorized persons may enter, and no one leaves until the report is released. Shortly before the report is to be distributed, the Secretary of Agriculture or his representative enters the board room for a first look at the commodity estimates. He receives a briefing on the report (which has been printed inside the locked area) and signs it.

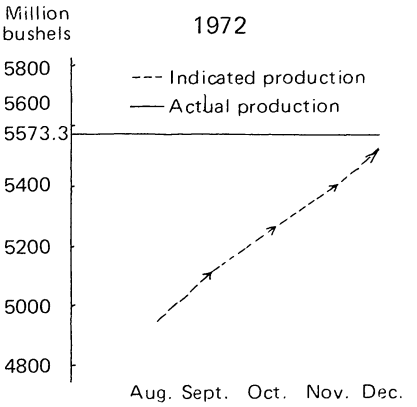
Minutes before the release time, the Chairman takes several copies of the report to the newsroom outside the locked area. Reporters from wire services, newspapers, radio, television, and brokerage houses wait behind a restraining line for copies of the report. At the exact release time, the report is made available to everyone in the room.

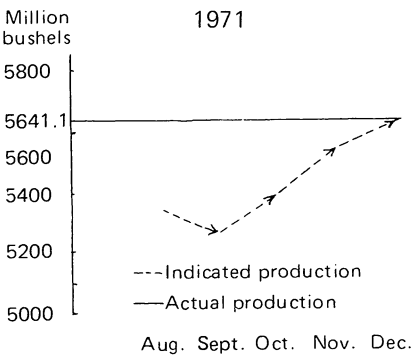
Figure 1. Corn indicated production by months

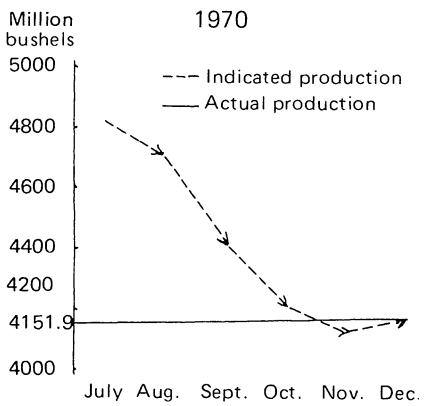


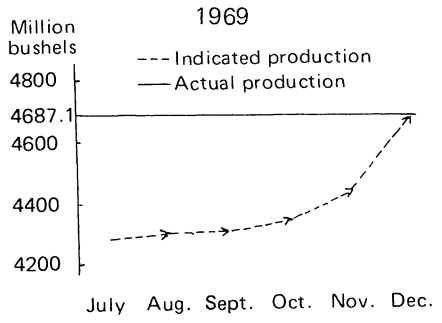


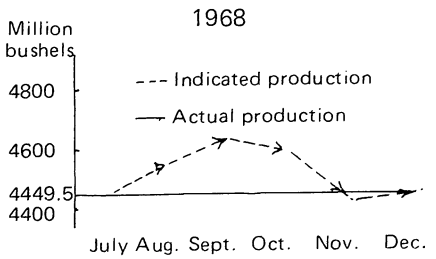


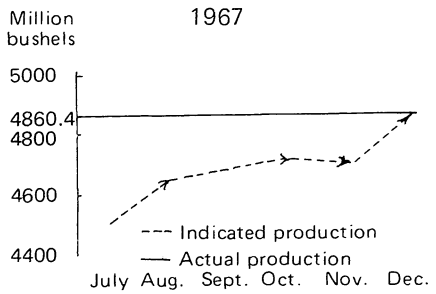


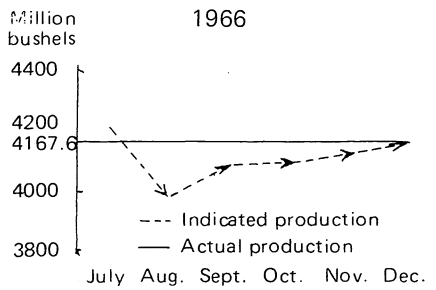


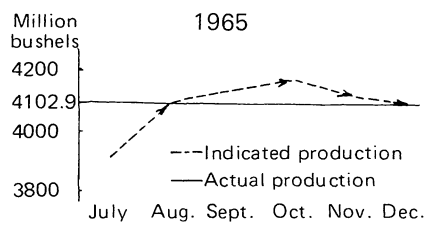


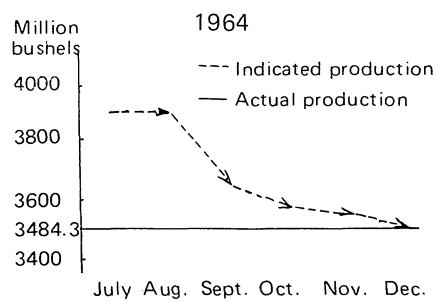


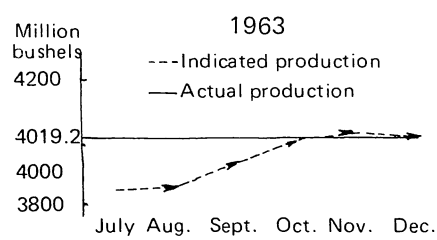












State and national estimates go immediately by telephone, computer, or facsimile to the SSOs where the information is announced to local news media. Later, full reports are mailed to individuals requesting them.

Using the information

Gathering, summarizing, and publishing crop and livestock data is time-comsuming and expensive. How is this information used, and who uses it? To begin with, farmers, themselves, are major users of the data. Of course, the value of the information depends partly on the type and size of the farmer's operation.

To a cash-crop farmer, early-season indications of planting intentions can be quite helpful. For instance, if large increases in corn acreage are projected, the farmer may decide to plant less corn and more soybeans. Estimates of total production during the crop year may help a producer decide whether to sell, store, or feed his grain. The same can be said for farmers' use of data on livestock numbers, type, weights, slaughterings, breeding intentions, etc.

Other important users of agricultural statistics are farm organizations, agribusiness firms, commodity traders, business analysts, state and national farm policy makers, and foreign buyers of agricultural products. These groups want accurate

Table 1. Corn: errors in production forecasts, 1963-1975

Crop year	Maximum forecast error*	Month of maximum error
	Percent	
1963	− 4.2	July
1964	+11.6	July
1965	− 4.7	July
1966	− 4.5	August
1967	− 7.3	July
1968	+ 4.2	Sept.
1969	− 8.6	July
1970	+16.1	July
1971**	− 6.7	Sept.
1972**	−11.2	August
1973**	+ 2.1	Sept.-Oct.
1974**	+ 7.1	Sept.
1975	+ 4.8	July

*"Forecast error" is the difference between the monthly corn production forecast and the final yearend estimate of actual production. A plus sign (+) indicates an overestimate; a minus sign indicates an underestimate.
**No July estimates were made in these years.

Table 2. Corn: average error in production forecasts by month, 1963-1975

Month	Average monthly forecast error
	Percent
July	6.5
August	5.6
September	4.3
October	2.6
November	1.6

Table 3. Soybeans: errors in production forecasts, 1963-1975

Crop year	Maximum forecast error*	Month of maximum error
	Percent	
1963	+4.2	Sept.
1964	+6.7	August
1965	+2.5	Sept.
1966	−7.3	August
1967	+2.7	Sept.
1968	−3.8	August
1969	−6.9	Sept.
1970	−1.2	August
1971	+5.1	August
1972	+6.3	Nov.
1973	+3.4	Sept.
1974	+8.3	Sept.
1975	−5.2	Sept.

*"Forecast error" is the difference between the monthly soybean production forecast and the final yearend estimate of actual production. A plus sign (+) indicates an overestimate; a minus sign indicates an underestimate.

and up-to-date information on which to base purchases, sales, economic projections, policy recommendations, new investments, outputs of related products such as fertilizer and machinery, and many other public and private activities. The eagerness which which newly released crop reports are seized by reporters and relayed to the public attest to their value in today' world.

The record of accuracy

What's the SRS's track record in forecasting corn and soybean production. Beginning with July for corn and August for soybeans, SRS issues monthly forecasts of indicated *production* (July corn forecasts were not made in the 1971-74 period). Acreage data for these estimates are fairly firm by then. So changes in indicated production are mostly from changes in yield estimates as each growing season unfolds.

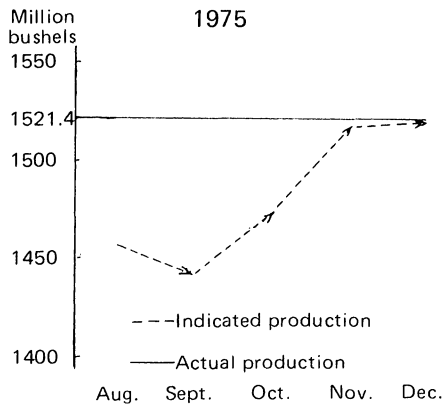
Forecasting corn production

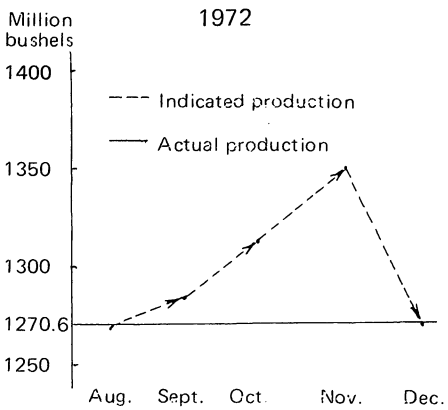
Accuracy in forecasting season by season corn production for 1963 through 1975 is shown in figure 1. The solid line in each year's panel is the final estimate of that year's production made after the close of the season. (This figure goes into the official statistics.) The dotted line in each panel shows the progress of the SRS forecast from July to December.

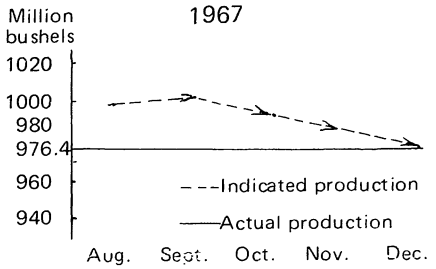
In some years (such as 1964 and 1970), the forecasts started off too high and then gradually closed in on the final figure. In other years (such as 1969 and 1972), the early forecasts were too low initially and then crept up toward the final estimate. In a few years (such as 1965 and 1966), they started off too high or low and then reversed themselves to the other side of the line before moving toward the final figures. Recall that most of the month-to-month changes in these forecasts are because of changes in yield estimates which reflect the uncertainties of weather and pest problems. These hazards generally cannot be predicted or measured in advance. Consequently, much of the difference between an individual forecast and the final production figures is not an "error" in the sense that better measurement could eliminate it. It is because of the impact of basically unpredictable forces.

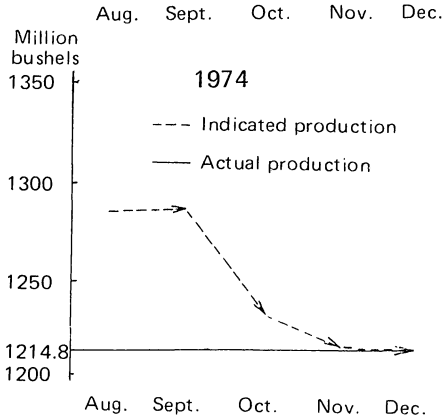
Note the large, early overestimate in 1970—the year of the corn blight. That year, the forecasts were revised

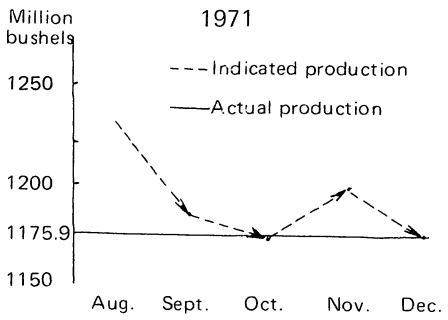
Figure 2. Soybeans indicated production by months

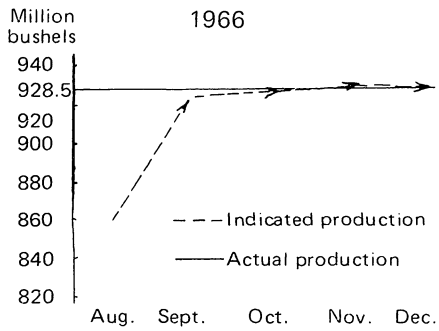


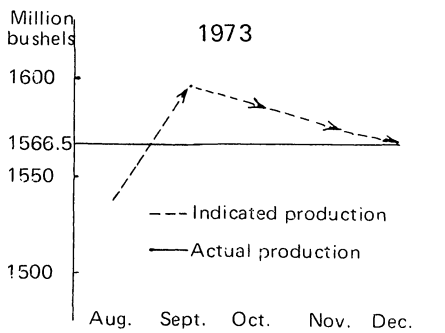


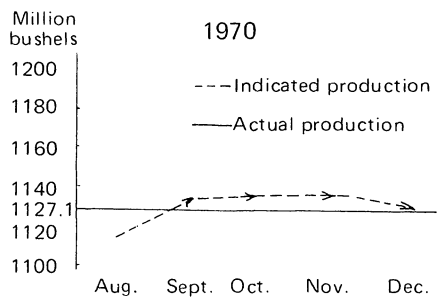


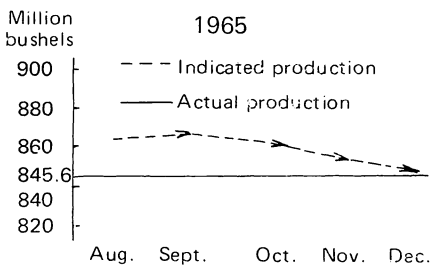


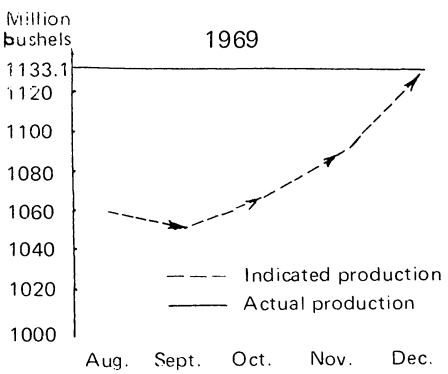


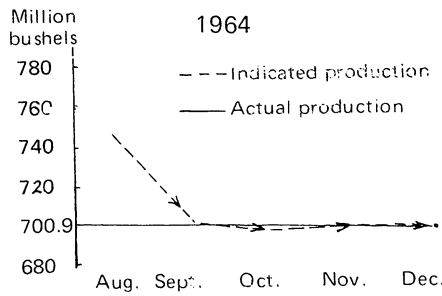


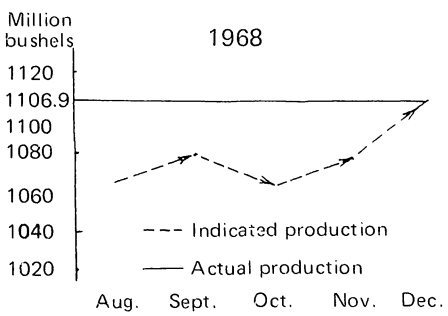


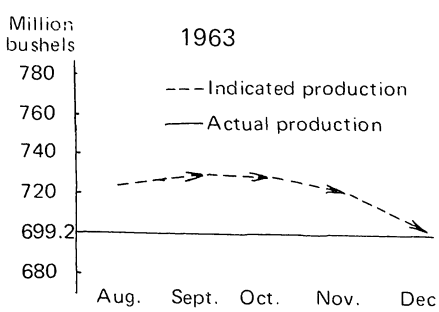












downward through the season as reports poured in of new, serious infestations. In 1974, the large rapid drop of the forecast late in the growing season occurred when record early frosts and poor harvest time weather occurred throughout many production areas. Over this 13-year period, early-season overestimates occurred about as often as early-season underestimates. No systematic biases or tendencies seem to occur in the forecasts of corn production.

In addition, the overall record of accuracy in SRS corn forecasts appears quite good. For each crop year in the period, table 1 contains the *maximum* forecast error in percentage terms and the month in which it occurred. Almost always, the largest

error occurred in July or August and then narrowed as the season progressed. The average *maximum* error was about 7.2 percent above or below the actual output. Table 2 shows the pattern of average error in corn production forecasts by month. Note the definite trend toward more accurate forecasts as the season progresses.

Forecasting soybean production

Figure 2 shows the record of accuracy for soybean production forecasts for 1963 through 1975. Soybean production is first forecast in August. The experience in individual soybean crop years during the period can easily be seen from the individual panels in figure 2.

Notice that soybean production forecasts are generally less subject to revision than corn forecasts. Table 3 confirms this; it has exactly the same interpretation for soybeans as table 1 has for corn. Projected soybean yields fluctuate less from month to month than do corn yields. So once the planted acreage is fairly well known, soybean production is easier to forecast than is corn production. The average maximum forecast error for soybean production during the 13-year period is only about 4.9 percent above or below the actual output. Table 4 shows the pattern of average error in soybean production forecasts by month. Once again, the forecasts become more accurate as the season progresses.

James P. Houck (left) is professor and Daniel Pearson is research assistant in the Department of Agricultural and Applied Economics. Former undergraduate research assistant Pam Beckman helped analyze the data.

Table 4. Soybeans: average error in production forecasts by month, 1963-1975

Month	Average monthly forecast error
	Percent
August	3.9
September	3.0
October	2.4
November	1.8

Individuals interested in receiving reports from the Minnesota Crop and Livestock Reporting Service may request a list of available publications by writing to:

Minnesota Crop and Livestock Reporting Service
Suite 270, Metro Square Office Bldg.
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Roland H. Abraham, Director

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Acts of May 8 and June 30, 1914

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Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108.

John J. Waelti . . . . . Editor

Prepared by the Agricultural Extension Service and the Department of Agricultural and Applied Economics. Views expressed herein are those of the authors, but not necessarily those of the sponsoring institutions. Address comments or suggestions to Associate Professor John J. Waelti, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota 55108.

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