Chapter 16

Linking Corn Production, Climate Information and Farm-Level Decision-Making: A Case Study in Isabela, Philippines

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16.1 Introduction

Corn is the second most important crop in the Philippines in terms of total area planted and overall value next only to rice. Yellow corn is the most important corn type in the Philippines, and is primarily used as feed especially for poultry and swine. In 2003, more than 844,885 ha of agricultural land in the Philippines were planted to yellow corn.

Isabela is the top corn-producing province in the Philippines contributing 17% or 536,353 tons of the country’s total yellow corn production in 2003. It is located in the northeast region of the country and is about 10 hours drive north of Manila. Corn is grown rainfed in lowland, upland, and even in riverine or flood-plain areas along the Cagayan River in Isabela. Monocropping of corn is predominantly practiced in Isabela, and there are two cropping seasons per year – wet season cropping from May to August and dry season cropping from November to February. A total of 146,965 ha were planted to yellow corn in the province in 2003. Average yield of yellow corn was 3.65 tons per hectare (t ha$^{-1}$) in 2003 which was comparatively higher than the national yellow corn yield average of 3.03 t ha$^{-1}$. Most of the corn type being produced in the province is yellow corn which accounted for 95% of the total corn produced in the province (Lansigan et al. 2001).

The climate in the agricultural region of Isabela has historically no pronounced dry or wet seasons but relatively dry in the first half of the year and wet during the second half. Average rainfall is 1,844 mm per year, mean temperature is 29 °C and relative humidity is 66% (PAGASA 2000). In general, the climate and the vast plains of Isabela are suitable for corn production.

Improvements in our understanding of interactions between the atmosphere and its underlying sea and land surfaces, advances in modeling the global climate system, and the substantial investment in monitoring the tropical oceans now provide a degree of predictability of climate fluctuations at a seasonal lead time in many parts of the world (Hansen 2002). Climate information influenced corn production activities and decisions. Through time, corn farmers have developed management practices and adaptation measures to cope up with climate variability. This chapter examines the perception of corn farmers and of the agricultural extension workers on the links between corn production, climate forecast information, and farm-level decision-making in two different corn agro-environments in the Isabela province of northern Philippines.
16.2 Methodology

16.2.1 Case Study Sites

Isabela province is located in the northernmost part of the Philippines (Fig. 16.1). Two corn-producing municipalities were identified for the case study representing different agro-environments, namely: (1) the lowland corn areas in the low-lying, flood-prone areas in the town of Naguilian; and (2) the upland corn areas in the nearby mountainous municipality of Benito Soliven. The two towns are located about 15 kilometers apart. Naguilian (121°50' E latitude and 17°60' N longitude, elevation 40 m) has low-lying corn-growing areas located near the Cagayan River – one of the most important rivers in northern Philippines. It has a land area of 170 km$^2$ and a current population of 26,131. On the other hand, Benito Soliven (121°60' E latitude and 17°00' N longitude, elevation 98 m) is a mountainous corn-growing municipality. It has a land area of about 187 km$^2$ and a population of 22,146.

Fig. 16.1. Map showing the location of the municipalities of Naguilian and Benito Soliven in Isabela Province, Philippines
16.2.2 Data Collection

A number of activities and decisions in corn production are influenced by available climate information in the area. These include the date of land preparation and planting, choice of corn cultivars to grow, scheduling of applications of fertilizer and irrigation water, and harvesting. A necessary step in promoting agricultural use of climate information, or in assessing its value, is to gauge user perceptions concerning the use of that information (Stern and Easterling 1999). Thus, to assess the perceptions of corn farmers in Isabela province on the links between corn production, climate forecast information, and farm level decision-making, a survey involving 60 farmers (30 from each municipality) and 40 agricultural extension workers was performed from November to December 2003. The study used personal interviews, and a structured survey questionnaire to interview corn farmers and local agricultural officers and extension workers.

16.3 Results and Discussion

A typical corn farmer surveyed in Isabela, Philippines is male, 43 years old, has received high school education, and has about 18 years of corn farming experience. He owns about 2 hectares of relatively flat, agricultural lands that is solely planted to corn. An unpaved feeder road connects his production site to the market. On the average, his farm is about 6 km away from the nearest market and about 7.6 km away from the nearest Department of Agriculture extension office. On the other hand, a typical agricultural extension worker or agent interviewed during the survey in the province is 40 years of age, has received a university or college degree, and has 14 years of experience in agricultural extension work.

According to the farmers surveyed, corn is primarily grown in Isabela province because of its existing market, lower manpower requirement compared to other crops, and general suitability to the area. Corn farmers raise yellow hybrid corn twice a year. The average corn yield is 4,330 kg ha$^{-1}$ during wet season cropping (May–August), and 4,719 kg ha$^{-1}$ during dry season cropping (October–January).

16.3.1 The Impact of Climate Variability on Corn Production

Countries in Southeast Asia and the Pacific region, together with Australia, experience the highest rainfall variability in the world (Nicholls 1997). El Niño events are manifested in the Philippine local climate by drier than normal weather conditions which could last for one or more seasons, causing dry spells or even drought in many parts of the country. These dry weather conditions are caused by suppressed tropical cyclone activity in the western equatorial Pacific, weak monsoon activity characterized by “breaks”, and the delayed onset of or early termination of monsoon rains (PCARRD 1999). In agriculture, shortage of water has caused serious damage to farmlands. The
Philippine Crop Insurance Corporation (PCIC) reported that claims of losses for rice in the Philippines in 1997 amounted to U.S.$280,000 while corn claims amounted to U.S.$480,000.

Compared with the El Niño event, which is characterized by unusually warm ocean temperatures in the equatorial Pacific region, La Niña is characterized by unusually cold ocean temperatures in the equatorial Pacific region. This condition brings greater than normal amounts of cloudiness and rains over the warm waters of the western Pacific including the Philippines. During the last half century, there have been about 10 to 11 weak and strong El Niño events which has brought adverse socio-economic impacts in the Philippines. The 1982–1983 El Niño event caused about U.S.$500 million damages to the Philippines as compared to the U.S.$13 billion global damage.

In northeastern Philippines, Dammay (2003) reported that weather disturbances in the form of flooding and drought are the primary contributors to corn production losses. Based on farmers’ reports during the past crop years, typhoon damage can cause a 70% yield loss while flood occurrence can wipe out an entire corn crop. Drought can result in a 50–70% yield loss. However, for the farmers surveyed in Isabela province, the 1997–1998 El Niño occurrence resulted in an average yield loss of 1,276 kg ha\(^{-1}\) of corn harvested representing about 27% of the seasonal corn yield per hectare. The survey also showed an average loss of 700 kg ha\(^{-1}\) of corn during the succeeding 1998–1999 La Niña event which represents about 16% yield loss – a lower level of damage compared to the earlier drought period.

In the Asia-Pacific region, El Niño event is often associated with clear skies and droughts, while La Niña episode is related to overcast skies and flooding (Centeno et al. 2000). As regards the El Niño and corn production, majority of corn farmers surveyed in Isabela have a negative view of its effects on corn production as shown in Table 16.1. However, during La Niña, the topography of the corn-growing municipality has a significant effect on the perception of the farmers interviewed with regard to their views on the effects of La Niña on corn production. Farmers of Benito Soliven – a mountainous municipality, viewed La Niña favorably since it brought adequate moisture – thus greater yield to its rainfed production system. On the other hand, majority of farmers from Naguilian, a lower elevation municipality that is flood-prone during typhoon seasons, took the negative view when it comes to La Niña occurrence.

Table 16.1. Farmers’ perception on the effect of El Niño and La Niña events on corn production in Isabela, Philippines

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Good (%)</th>
<th>Bad (%)</th>
<th>No effect (%)</th>
<th>Not aware of (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of El Niño</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benito Soliven</td>
<td>0</td>
<td>90</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Naguilian</td>
<td>7</td>
<td>90</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Effect of La Niña</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benito Soliven</td>
<td>90</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Naguilian</td>
<td>7</td>
<td>83</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>
These survey results are also consistent with the general pattern of observations from Isabela corn farmers during the 1997–1998 El Niño event and the succeeding 1998–1999 La Niña episode. During the 1997–1998 El Niño period, actual data in Isabela province showed that it lost 218,983 metric tons of corn valued at U.S.$36 million due to drought. During the succeeding 1998–1999 La Niña episode, typhoons and flash floods destroyed 10,738 hectares of corn incurring a production loss of 10,976 metric tons (Lansigan et al. 2001).

16.3.2 Climate-Related Information Currently Accessible in Isabela

Table 16.2 shows the sources of climate-related information among agricultural extension workers and corn farmers in Isabela province. Among government agricultural extension workers, the primary source of climate-related information is the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) – the government meteorological agency. This is followed by television and radio, print media (e.g. newspapers), and fellow extension agents. All Philippine agricultural extension workers and agents received university or college degrees which suggest their “comfort in accessing” meteorological bulletins. This is not the case for farmers – a majority of whom did not have university- or college-level education. Farmers derive their climate-related information from mass media – mainly from radio and television broadcasts, and also from their fellow farmers. This situation makes it critical for climate and agriculture policy makers to focus on the commonality among agricultural workers – both extension agents and farmers- which is the importance of radio and television as a means for effective dissemination of climate information and forecasts.

16.3.3 Impact of Seasonal Climate Forecast Information on Decision-Making

Blench (1999) reported that forecasts are only relevant to producers that conform to the following profile: large and specialized operations, high in resources like education, and dependent on rainfall. In the case of Isabela, forecasts were important since the corn production system is generally rainfed. Besides the relatively rich and edu-

<table>
<thead>
<tr>
<th>Source</th>
<th>Agricultural extension workers (%)</th>
<th>Farmers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAGASA</td>
<td>42</td>
<td>–</td>
</tr>
<tr>
<td>Agricultural extension workers</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Farmers</td>
<td>–</td>
<td>43</td>
</tr>
<tr>
<td>Publications</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>Radio and television</td>
<td>28</td>
<td>51</td>
</tr>
</tbody>
</table>
cated farmers, even farmers with small to large crop hectarage, and of different academic backgrounds have signified their need for climate forecasts aside from the relatively rich and educated farmers.

The survey also noted that all farmers interviewed were not willing to change crop species even with advanced climate information. What they were willing to modify include the choice of corn cultivars to grow, planting date, and time of fertilizer application. Capital, the cost of farm inputs, the previous season's price of corn grains and their perceived seasonal climate outlook have equal influence on Isabela corn farmers' production decisions.

16.3.4
Forecast Information of Greatest Value to Corn Production

Table 16.3 shows that agricultural extension workers view the onset of the rainy season, duration of rainy days, rainfall distribution, and drought and typhoon occurrence as equally important climate information that they would like to request to be made available to them. On the other hand, farmers’ most requested information is the duration of rainy days. This information is important in scheduling land preparation and planting. While the Philippines experiences, on the average, about 20 typhoons annually and Isabela is along the typhoon belt, there was very little need for typhoon-related information since it is considered a regular occurrence in Isabela (PAGASA 2000). Farmers and extension workers are quite satisfied with the advance typhoon warnings and advisories of PAGASA. However, majority of the extension agents and all of the farmers interviewed would like a lead time of at least 1–2 weeks for their advanced climate-related information to be significantly useful in corn production. This lead time is seen as an adequate enough period to adopt or make the needed adjustments or decisions on corn production-related activities such as planting and fertilizer application.

16.3.5
Effective Medium for Communicating Climate Forecast Information

Communicating uncertainty in climate forecasts is one of the major challenges in bringing forecast information to end users (Phillips et al. 2000). This is further complicated by regional dialects, many of which are limited in expression of abstract concepts which are often associated with climate prediction and forecasts. Climate forecast information containing relevant information leading to improved production decisions must reach the end users – the corn farmers, well in advance so that a farm-level decision can still be made. Both educated farmers (those who receive high school education and above) and less-educated farmers (those who have received elementary education only) have indicated their preference to receive climate forecast information primarily through mass media followed by personal contacts with extension agents. For policy makers, mass media, especially television and radio can be a cost-effective means of communicating climate-related information (Table 16.4). However, translating imperfect ENSO-related climate forecasts into information useful for improved farm-level decision-making remains a challenge that needs to be addressed. Climate forecast information should be translated to layman's terms as farmers and
the extension workers often perceive these forecasts as absolute values and do not interpret the information in probabilistic sense. This presents an important consideration in implementing intervention strategy for farmers and extension workers to better appreciate and increase awareness of the value of climate forecasts to corn production.

### 16.4 Summary and Conclusions

El Niño event and the drought it brings is viewed by majority of Isabela corn farmers to have a far greater negative effect on their production system compared with La Niña episode since most of the corn areas are rainfed. For the farmers surveyed in Isabela province, the 1997–1998 El Niño occurrence resulted in an average yield loss of 1.276 kg ha\(^{-1}\) of corn representing about 27% of the seasonal corn yield per hectare. The survey also showed an average loss of 700 kilograms of corn per hectare during the succeeding 1998–1999 La Niña event which represents about 16% yield loss. Farmers growing corn in mountainous communities such as in the municipality of Benito Soliven view La Niña occurrence as something beneficial to corn production considering their rainfed production system. Meanwhile, farmers in low-lying communities such as in Naguilian look at La Niña as something negative that can bring with it floods that can destroy their crops.

Agricultural extension agents derive their climate-related information primarily from the national meteorological agency (PAGASA) while farmers rely on television
and radio for their advanced climate/weather information. Extension agents were not the main source of climate-related information for farmers. All farmers interviewed were not willing to change crop species even with advanced climate information. However, they were willing to modify only the choice of corn cultivars to grow, planting date, and time of fertilizer application.

Capital, the cost of farm inputs, the previous season’s price of corn grains and their perceived seasonal climate outlook have equal influence on Isabela farmers’ corn production decisions. Moreover, farmers’ most requested information to be made available is the duration of rainy days. Both agricultural extension agents and farmers agreed on 1–2 weeks as the most ideal lead time for the delivery of climate forecast information. Television and radio broadcasts were the preferred medium for the delivery of climate forecast information. However, translating imperfect ENSO-related climate forecasts into information useful for improved farm-level decision-making remains a challenge that needs to be addressed. There is a need to translate the climate information and forecasts in terms of what the corn stakeholders can interpret and use correctly to guide decision-making in corn production system.

Acknowledgements

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References