The Impact of Accurate and Timely Issue of Climate Forecast and Agrometeorological Warnings on Policy and Decision-Making

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Abstract

Since 1968, The Gambia had seen a sharp downturn in rainfall leading to greater inter-annual variability and lower agricultural production. Addressing the concerns raised by climate variability and extremes through provision of timely and accurate forecasts to the public is impeded by several factors. Both human and financial resources are dwindling quite rapidly, so that the information providers are facing an increasingly difficult uphill task in their drive to reach the diversifying user community. The potential users of the climate forecasts and agrometeorological advice (farmers, decision-makers) do not understand the economic benefit of using meteorological information in their activities.

In light of the need to forge a close relationship between information producers and users, it is still seen that a lot of work is needed before meaningful progress is registered.

Timely and accurate climate forecasts and agrometeorological warnings are useful tools for policy and decision-making, but can only be achieved if executed and applied in close and continuous cooperation with the "data users".

Introduction

The Gambia, like other Sahelian countries, has an economy that is largely dependent on rain-fed agriculture, noted for its sensitivity to climate variability and extremes, particularly drought (Gomez, 2001).

Weather affects crops at all stages of their growth cycle and is therefore a key factor of production. Furthermore, weather-related fluctuations in the supply of farm products are echoed by fluctuations in commodity prices, hence in farm income. In the case of extreme meteorological events (e.g. droughts, floods) disruption reverberates throughout the economy.

It is thus certain that in an agricultural production system, advance information on key rainy season variables, in the form of climate forecasts and agrometeorological warnings are crucial for improving production. In the Gambia however, such information is not being routinely applied in agricultural production.

Answers to concerns such as to when to plant, or whether to plant a certain crop cultivar or even to invest in seasonal agriculture, when to apply fertilizer etc., are still a long way off from getting satisfactory answers. It appears that potential users do not understand the economic benefit of using meteorological information in their day-to-day agricultural activities, hence the low demand for such information. Such being the case, the National Meteorological Services (NMSs), have since the mid-nineties, embarked on the path of greater engagement of the farming community.

For the NMSs, the provision of such services also raises the profile of the institution which is an important factor in attracting scarce government resources allocated on a competitive basis.

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Climate forecasts and agrometeorological warnings

Climate and weather forecasting for agricultural applications is very much a demand-delivery activity. The NMS needs to collect and process the basic data, and transmit information generated in clear understandable language to government services, and, when necessary, to primary producers (farmers, herdsmen).

The following information products are provided to the user community:

1. **Climate Forecast:** This deals with expected atmospheric conditions and inter-annual variability obtained from statistical analysis of long series of data. This type of forecast is particularly geared towards agricultural strategic planning which includes the choice of farming systems and of the basic characteristics of crop varieties, the need for mechanization of specific agricultural activities, and type of water conservation measures to be adopted.

2. **Weather Forecast:** This type of product places its focus on day-to-day agricultural activities that require real time information on prevailing weather conditions, and expected conditions over the next 2 to 3 days in the future.

3. **Agrometeorological warnings:** Agrometeorological warnings in the form of advice and real-time information about the season and the alternative operations are issued.

To ensure wide and effective dissemination of the information (forecast, warnings, definition of conditions affecting crop growth in its widest sense), the NMS has built and maintains an active partnership with agricultural extension services, pest management services, information department, veterinary services, etc.

At this point, it is useful to present some agrometeorological variables that feature in the forecasts, and which may be immediately identifiable with certain users.

Rainfall

Starting in 1998, long-term forecasts have been issued at the beginning of each season. The forecast indicates whether the seasonal rainfall depth will be below normal, normal or above normal. Information relating to such forecasts is used to select the most suitable crop variety to sow. Evaluation of the possible length of the growing season is made from statistical analysis of climatological data, indicating for example the geographic areas that have expected growing season lengths of 80, 100 or 120 days.

The release of such information to farmers is expected to enhance their choices and planning activities (e.g. weeding, fertilizer and insecticide or fungicide applications).

However, the definition of mid-season dry spells and their duration, early in the season, is one area that would undoubtedly be of immense economic importance to the farming community.

Weather forecasts including the occurrences of line squalls, and un-seasonal rains in the Gambia are issued daily, and help shape decisions in weather sensitive economic operators in general, and agriculture in particular.

Rainfall forecasts are also used by planning institutions to conduct crop yield assessment, in the framework of food security.

Temperature, humidity, wind

Short range temperature, humidity and wind (2 to 3 days) forecasts allow meteorologists and agriculturists to evaluate the risks of the spread of plant diseases, and risks associated with outbreaks of large–scale insect attacks that only occur under specific meteorological conditions.

Additionally, air temperature and humidity forecasts are of considerable value in evaluating harvest conditions.

Soil Water Balance

In the semi-arid areas, more than anywhere, soil water balance affects almost all stages of crop production.

Using information on soil water balance, agricultural services are in the position to advice competent government authorities and extension workers on the occurrences of plant moisture stress due to early or mid-season dry spells, and adaptation options suited to the circumstances.

The Gambia pilot project in agrometeorology

Genesis of the Project (MWG, 1988)

In 1988, the already existing Multi-disciplinary Working Group (MWG) of the AGRHYMET Programme in The Gambia, finalized a project proposal entitled "Testing of the Application of Agrometeorological Data and Information to Continue to Enhance Food Production". With a life span of four years, the project design was such that the first two years would be for experimental purposes and the other two years for extension. In other words, the first two years would serve as a learning process for members of the MWG and farmers participating in the project, whilst dissemination of the new concept of using agrometeorological data in farming practice to other farmers would be in years 3 and 4.

The project proposal was finally picked up for funding in 1992, by the Government of the Netherlands, through WMO. For the implementation of the project, a Pilot Project Coordination Committee (PPCC) made up of the following membership was established:

- Agricultural Services (Extension and Phytosanitary specialists);
- Information and Broadcasting (Print and Radio media specialists);
- Agricultural Research (Agronomy);
- Water Resources (Agrometeorology and Hydrology).

The Department of Non Formal Education Services, playing a vital role in adult literacy and numeracy, was later welcomed to the PPCC.

The PPCC oversaw implementation of phase I of the project in the rainy season of 1993 in four pilot sites: Yallal (North Bank Division), Sare Soffie (Central River Division), Kiang Karantaba (Lower River Division) and Jambanjali (Western Division). In 1994 new sites were installed in Naudeh and Fatoto both in the Upper River Division.

Criteria used for the selection of the above six sites were as follows:

- Presence of active Crop Extension Service;
- Predominance of one of the major crops sown in the country.

Project Objectives

The long-term objective of the project was to contribute to the enhancement of agricultural production of The Gambia, by encouraging the farming community to use agrometeorological and hydrological information in carrying out production-related activities on the farm.

Methodology

In each of the six sites selected, four fields of millet, groundnut, sorghum and maize were established. Each field was divided into four plots according to the following experimental design, in order to evaluate differences in the use or otherwise of fertilizer and agrometeorological advice:

- Plot I: Use of agrometeorological advice and chemical fertilizer;
- Plot II: Use of chemical fertilizer but no agrometeorological advice;
- Plot III: Use of agrometeorological advice but no chemical fertilizer;
- Plot IV: No agrometeorological advice and no chemical fertilizer.

Plots II and IV were farmer's plots, using traditional farming practices; while plots I and III benefited from recommended practices and advice issued by the MWG of the AGRHYMET Programme

A special consideration to the implementation of the project objectives was the fact that the majority of the farming community cannot read or write in English, thus spurring the PPCC to translate the agrometeorological advisories into local languages.

Forecasts and warnings on the abnormality of the rainy season and the possible occurrence of dry spells were issued. Information on the probability of the start of rains and on optimum planting dates of various crops and varieties were also issued.

At the end of the season field days were organized and farmers from the surrounding villages were taken on a tour to experimental plots, to evaluate the role and economic value of agrometeorological information and advice, and interact farming and technical staff of the project.

Assessment of the Experimental Phase

A Tripartite Review Meeting of the Pilot Project held in May 1995 brought together a representative of the donor (Government of the Netherlands), the executing agency (WMO, AGRHYMET and UNDP), and members of PPCC.

The review panel made the following major observations:

- Orientation of field staff was inadequate, with the consequence that the information passed on to the farmers was not clear enough;
- The nature of the data/information provided by the PPCC to the farming community was not clearly defined;
- The design and protocol of the project did not emphasize the impact of agrometeorological advice to increase yields;
- Participating farmers' reactions and appreciation were absent from the end-of-project report; and
- Training of farmers, agricultural field staff, and media personnel, was paramount for the success of the project.

Although pertinent, notice that these comments were made at a time when the project was at the experimental stage, and therefore a learning opportunity for both the PPCC and the farming community. Unfortunately, the extension phase did not take off due to the withdrawal of the donor, apparently for political reasons.

Results

Despite the above constraints, results from the basic analyses revealed a highly significant response of crops to fertilizer and timely agrometeorological practices. Increased percentages of 13 and 23 in actual millet yields were registered at Pirang in plots I and III as compared to the farmer's plots II and IV. According to Alimi, 1991, timely agronomic practices and agrometeorological advice are of more value to the farmer because the information was cheap.

Implications for policy- and decision- making

The immediate-term policy problem of the agricultural and natural resources is to increase agricultural production. This policy problem is manifested in low farm income, growing rural poverty and household food insecurity, accelerated rural-urban migration and rapid environmental degradation.

Results and lessons learnt from the pilot study suggest that successful agriculture and natural resources policies require good quality information and improved knowledge on the climate/weather system. The use of climate information and knowledge derived therefore can help farmers and decision-makers plan their day-to-day activities.

Pilot Project

Production

The date of onset of the rains and the prediction of early and mid-season dry spells are useful indicators as to whether the season is likely to be good, bad or average. Further development of this approach, together with a more efficient use of scarce resources offers the prospect of greater stability of crop yields, especially in seasons with poor rainfall. Parry et al. (1988) for example suggest the management strategies in a maize-beans production system.

- Poor season – No fertilizer top-dressing, no inter-cropping and reduction of plant population by thinning;
- Average season – No fertilizer top-dressing, inter-cropping permitted and standard plant population;
- Good season – Fertilizer top dressing recommended, inter-cropping permitted and plant population kept at standard level.

The knowledge on meteorological events can seriously affect the agricultural activity and can lead to the substitution of other more resistant crops, as was the case in the Gambia during the year 2002. In light of the late onset of rains, farmers were advised to cultivate watermelon, sesame, etc., due to their short cycle.

The most promising application of weather prediction is to determine when it will be an average or good season, so that additional input and hired labour may be considered. Greater access to and use of draught animals may also be critical.

Food security

Present government policy is to achieve national food self-sufficiency and to have a strategic reserve. In case of depletion of this reserve, food imports are made before the locally planted crop is harvested. Thus, in 2002, when it became apparent that widespread crop failure could be expected due to poor rainfall, the effect on this strategic reserve was anticipated. Surplus production could then be sold or stored for the inevitable drought. The government was also involved actively in seed multiplication.

Marketing

Timely and accurate information on the climate helps the government to improve the inter-regional transfer of food by improving transport networks and establishing appropriate trade arrangements.

Routine Forecasts

Routing forecasts are of importance to the population as a whole. We single out sectors of the economic activities that make the most use of such forecasts.

Transport

Forecasts are vital to both the safety of sea and air transport. With this information, decision-makers can better plan their transport activities.

Storage

Un-seasonal rainfall can have a serious effect on late maturing crops that are yet to be harvested or already harvested. Timely knowledge of such information does help farmers transport their harvests and allow decision-makers to built good storage facilities (seccos, sheds).

Fisheries

Recent weather-related tragedies in the local fishing industry call for closer interaction between the providers of weather information and the fishing community. Although this relation might appear less complex, resource constraints would pose a significant impediment for the successful implementation of any meaningful collaboration.

Weather forecasts including the occurrences of line squalls is vital especially to fishermen with light canoes. In the case of such line squalls, the fishermen are advised not to go to sea or to reschedule their programmes.

Conclusions

The potential benefits of climate forecast and agrometeorological warnings for decision-support in agricultural and natural resources management is beyond debate. However, climate forecast and agrometeorological warnings can only achieve their full value if conceived, executed and applied in close and continuous cooperation with the “data users”. Thus, successful policies require precise information on the weather and how it affects harvests.

Owing however to limitations in current practice, there is a need to improve the accuracy and clarity of forecasts issued and to ensure communication between information producers and users on the current and future conditions of the atmosphere.

There is a need also for increased complementarity among information, technology and public intervention through:

- Improved information on agroclimatic potential, i.e., a greater range of measurement, more computer–based analysis, more agroclimatic screening of environments to match agricultural activities to regional weather–types and improve weather forecasting;
- Improved use of new agricultural technologies (such as high–yielding varieties) to increase production potential in good years and reduce losses in poor years;
- A focus on integrated regional development to reduce overall vulnerability to drought by increasing public awareness;
- Development of a consistently applied and widely known set of drought policies to reduce the uncertainty that stems from ad hoc public intervention.

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Abbreviations

ACMAD : African Centre of Meteorological Applications for Development
MWG : Multi-disciplinary Working Group of the AGRHYMET Programme
NMSs : National Meteorological Services
PPCC : Pilot Project Coordination Committee
UNDP : United Nation Development Programme
WMO : World Meteorological Organization