Design and implementation of training program for the introduction of agrometeorological services in Cuba: Case studies of aquaculture and family farming systems

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ABSTRACT

The study describes the experiences in the design and implementation of a specialized training system for agrometeorologists and specialists in the productive sector. The selected production systems were aquaculture and family farming. The design of the actions considered the type of audience. A survey was applied to measure the impact of the actions. A postgraduate course on agrometeorology and its application in plant health was designed. It was delivered in two editions, with the participation of specialists from different areas of the country. The application of an instrument such as the student survey showed the training needs addressed to production and service personnel together, with the differences between publics. The results obtained showed a high level of satisfaction and usefulness of the knowledge received. Learning and updating knowledge can influence the future performance of students.

Key words: Specialized education, applied meteorology, Cuba, climatic services for agriculture.

INTRODUCTION

Professional education is a process, which starts from the comparison between the needs to cover each position and the previous training that the individual occupying it has, from there, work is done to fill that gap (Böhrt Pelaez, 2000).

When the actions of professional training are directed to the human talent of an organization, it is strengthened. According to Tannenbaum and Yulk (1992), people are essential for organizations and now more than ever, their strategic importance is increasing, since all entities compete through their personnel. The success of an organization depends more and more on the knowledge, skills and abilities of its workers. When the talent of employees is valuable, rare and difficult to imitate and above all organized, a company can achieve competitive advantages that rely on people.

In the specific case of agricultural meteorology at the international level, the World Meteorological Organization (WMO), specifically by the Agriculture Meteorology Programme (AgMP), makes the fundamental efforts. This applied science is largely responsible for the study of the effects of climate and weather on agricultural production, which includes both animals and crops; all this through updated services on climate change and technological advances; as well as its application in local agricultural and agro industrial systems (Walker, 2014). Agricultural meteorology, therefore, includes two basic thematic areas: (i) Physical sciences specifically the physics of the environment (that is, meteorology and climatology), (ii) Soil physics and hydrology and (iii) Biological sciences - specifically physiology, ecology, phytopathology, epidemiology and associated disciplines of agriculture such as agronomy and horticulture.

The lack of adequately trained personnel at all levels, especially in the agricultural and horticultural industry can be another major obstacle to the application of agricultural meteorology. Wieringa (1996) cited by Lomas et al. (2000) showed that in the Netherlands, where information and
Forecast data are available by data link, almost none of the hundreds of agricultural advisors has subscribed to the agrometeorological service. Of this country, even though its cost amounts to 200 euros/year, several reasons can be postulated for this situation in a highly developed agricultural economy:

1). The advisors consider that weather information is not important,
2). Management applications are not available,
3). Advisors / counselors know very little about meteorology to appreciate or apply such information.

Wieringa (1996) cited by Lomas et al. (2000) concluded that lack of knowledge of meteorology is the most likely reason. Such is the situation in 19 countries in Western Europe as well as in the United States. The lack of economic justification for the application of meteorological information to agricultural practices can be another aspect (Maunder, 1989 cited by Lomas et al., 2000). Therefore, there seem to be several reasons for the lack of use of Agricultural Meteorological Services by the climate sensitive agricultural community:

1). The lack of cooperation between the institutions that provide information and the relevant notices and those responsible for their transfer to the agricultural community.
2). Insufficient education and training of the user community, including agricultural advisory services that provide specific agricultural advice from general meteorological information.
3). Absence of an economic benefit for the application of agricultural meteorological warnings.

These authors add that because the private sector is generally not very aware of the benefits of agricultural meteorology, in general it is not willing to contribute to education and professional training in the discipline. Currently, pre and postgraduate education of 'not exclusively' meteorological specialities is linked to Agrometeorology training. In this sense, according to Lomas et al. (2000), 20% of the actions come mainly from the agricultural faculties of several universities, while the agricultural scientific community supports with 57% of the 'efforts' of research, with a contribution of only 16% of the meteorological specialities.

Among the needs to be covered by education/training in agricultural meteorology, possible adaptation strategies are identified to increase climate variability and climate change (Stigter and Otros, 2013). Extreme weather causes damage everywhere, but regions with more resources are more likely to adapt (for example, to organize insurance). Absorption of new technologies takes place more quickly in these situations, which also reaffirms the importance of specialized training.

The general objective of this study was to design a scheme for the training directed to the specialists in Agrometeorology and agriculture of the selected areas (Villa Clara and Santiago de Cuba). The specific objectives were:

1). To prepare a training program on the topics identified in previous studies.
2). To develop actions of overcoming different types directed so much to the specialists of the meteorological service as of the productive sector.

MATERIALS AND METHODS

The development of the actions was based on the capacities available in the entities of the meteorological service (Provincial Meteorological Centers of Villa Clara and Santiago de Cuba) and the Faculty of Agricultural Sciences of the Central University Marta Abreu of Las Villas.

The type of audience was considered for the design of the surpassing activities. In the productive sector, the study was based on the Rural Science Stores (in English Science Field Shops), the experiences of Stigter et al. (2013) and Stigter et al. (2000); who in turn quote Garth (1980) with the Schools of Laws implemented in the Netherlands during the first years of the 70’s.

For the non-academic modality, in the specific case of the activities directed to the graduate technical personnel of higher level, the Regulation of the Postgraduate Education of the Republic of Cuba was taken into account (Resolution 132/2004, of the Ministry of Higher Education); as well as the guidelines of the Institute of Meteorology (INSMET). The models used in ordering the activities appear in the Annexes I to IV.

The use of the term modality is carried out according to the criteria of Lay et al. (2005):

I. Exchange spaces between agricultural producers and scientists / specialists interested in the application of their results from the establishment of services in the productive areas.
II. Self-preparation/self-improvement: A flexible modality selected, considering the characteristics of the work of the specialists; which is operative, does not allow prolonged absences from the job and the execution of numerous collateral tasks.
III. Workshops and team training: It allows the discussion of one or several topics collectively to find variants of solution, promoting group work, teamwork cohesion and collaboration.
IV. Conferences or seminars: They make it possible to provide information and / or knowledge about a specific topic.

RESULTS AND DISCUSSION

Training in agrometeorology must include a wide range of
levels and cover a very broad spectrum of interests. In the case of the actions directed to the productive sector, family farming systems (popular aquaculture) were not taken as reference, so the analyzes focused on areas of state production. Therefore, at first, the actions for meteorologists and producers in this sector were developed. The former are conceived as the intermediaries interested in the introduction of new information and the latter, as recipients thereof, who in turn participate in the elaboration and refinement of this information on an ongoing basis (Stigter, 2008).

These interests coincide with those recognized by several authors (Lomas et al., 2000; Salinger et al., 2000; Stigter et al., 2000) who mention, within the perspectives to address future actions of education, training and extension in agrometeorology, the need to incorporate strategies to cope with the effects of climate change and variability.

One observed situation was that potential groups of users of agricultural meteorological information lack a sufficient understanding of agricultural meteorology to make use of the information to be supplied (Agricultural Meteorology Division, India Meteorological Department (IMD), 2013). Lomas et al. (2000) recommend providing programs not only for specialists in our subject, but also for a much broader range of people who must understand the messages of specialists to act effectively on them.

Case 1: Agrometeorology for family farming (for integrated pest and disease management)

Two editions of the improvement actions were developed. At first, 22 specialists were trained, 91% belonging to the meteorological service. In addition, four provinces participated (Guantanamo, Las Tunas, Sancti Spíritus, Havana) and the special municipality of Isla de la Juventud. The majority of the students were men (59%), while 72.7% of the enrollment corresponded to graduates of the specialty of agronomic engineering. The technicians represented 7.4%, the rest were university students. In the second edition dedicated to specialists of the productive sector, it counted, unlike the previous one, in its majority with feminine students and no technician.

The summary of the participants is shown in Table 1.

Satisfaction of expectations
All students (32) answered this question, Table 2 shows the results.

Quality of lessons
The total number of students answered this question (32 surveys processed), which represented 100% of those evaluated. Table 3 shows the results obtained, where only one case in a single edition classified this indicator as Good.

Domain of the subjects taught
As shown in Table 4, the domain of the topics taught was evaluated as High by 100% of respondents in the first edition and by 93.7% in the second.

Academic rigor
In this case, all of the respondents characterized this element as Strong.

Relevance of the program
The pertinence of the postgraduate course is given by the response that its activities give needs for the economic and social development of the territory and the country. It must begins from the integration of the university and the productive and service entities, whose professionals demand of the permanent improvement for the solution of the scientific problems, technological and artistic elements that are inserted in policies and development programs (Cruz-Baranda and García-Quiala, 2012). For the two editions, most of the respondents rated the contents received as very useful (see Table 5), so that the knowledge imparted can be profitable from the practical point of view.

Exchange Alumnus – teacher
The interaction of the faculty that taught the topics with the chess in both editions was evaluated as Very Favorable (100% of the respondents).

Recommendations to the program, teaching staff and other topics
Recommendations to the program:
• That other edition of the course are carried out.
• That extends to other organisms.
• It is very good.
• Recommendations to be able to have practice time to evaluate the acquired knowledge.
• Fight for its sustainability.
• Include practical classes; increase the duration of the course.
• Possibility of visiting a Meteorological Station.

Recommendations to teaching staff
The following are the main topics identified by the survey.
At this point, recommendations were addressed to the teaching staff and the preparation of other courses by the same team. Complacency with performance was observed.

First edition:

- Make the bibliography more visible
- Continue teaching other courses
- Incorporate other specialists in other topics
- The teachers who participated were very well prepared, with real knowledge of their activity, so they should prepare other courses.
- The presentations of the professors seem very good and excellent
- Keep it going, it helps a lot of interested people
- Prepare other agricultural meteorology courses related to other areas
- It would be very good if you could organize a course together Agrometeorology and plant health
- The professors who worked on this issue of agricultural meteorology showed great skill and mastery of their specialty, conferences of great practical importance are given. Very pleased.

Second edition:

- Communicator and great mastery of specialty.
- I consider your acting excellent.
- Keep it up so she is a very good teacher, communicator.
- Continue the exchange
- The classes have been very pleasant, professional and demonstrate their ability, so
- I do not have recommendations, only wish you professional and personal success
- Stay updated on the subject
- Recommend, that the classes were brilliant, that the teacher explained it, with a lot of clarity and quality very happy.
- Teacher very well prepared.
- Brilliant teacher, excellent in the domain of the subjects, is surprising. None, the teacher is very prepared and is very
professional.

**Other themes**

The answers given by the students in each of the editions are listed below. As it is observed, during the first one, the most demanded subjects were forest fires and management of the water resources; while the second priority was the strengthening of the thematic links between the meteorological service and the agricultural sector.

First edition:
- Forest fires
- Agrometeorology, water and soil.
- Drought, fires and water resources.

Second edition:
- Pest development rates with greater emphasis on agricultural crops
- Modeling of diseases.
- Agrometeorology and Plant Health.

Another way was the insertion of a subject linked to the demands identified in a master’s degree, in this case, of sustainable agriculture. An engineer developed his master’s thesis at the Faculty of Agricultural Sciences, Marta Abreu Central University of Las Villas.

**Case 2: Agrometeorological service for aquaculture**

In this case, a workshop was held in aquaculture with the participation of nine specialists from the Operations and Industry Department. Regarding the training and updating of the professionals who participated in the project, the pre-preparation and the training received during the investigation played a fundamental role, with technologies and methods. Recent data acquisition and analysis in the updating of knowledge and skills have been demonstrated. Lomas et al. (2000), who add that there are numerous on-the-job training services within the meteorological services for the different levels, had already mentioned this form. For this research, although no postgraduate course was designed, 100% of the traders said they were VERY SATISFIED with the activities developed. On the other hand, the academic rigor was evaluated mainly as STRONG and the relevance of the program as VERY USEFUL. Among the main recommendations are to perform more frequently exercises of this type because of the importance of the issues addressed, in addition to including practical activities.

**Conclusions**

A postgraduate course on agrometeorology and its application in plant health was designed. It is delivered in two editions, with the participation of specialists from the provinces of Guantánamo, Las Tunas, Havana, Isla de la Juventud (special municipality) and Villa Clara.

The application of an instrument such as the student survey showed the training needs addressed to production and service personnel together, with the differences between publics. The results obtained showed a high level of satisfaction and usefulness of the knowledge received. Learning and updating knowledge can influence the future performance of students. Within future actions, ICTs should be incorporated into the actions of improvement, computer-assisted learning or computers using CDs or the Internet to develop self-study modules.

**REFERENCES**


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