TECHNICAL ARTICLE

INTEGRATING PROFESSIONAL EDUCATION, RESEARCH AND EXTENSIONIN IRRIGATED AGRICULTURE TECHNOLOGY CENTERS

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ABSTRACT: With the objective to stimulate the use of irrigation and the electric energy fee reduction during night time program granted by the 2004 Federal law, the Government of the state of Paraná, Brazil launched the Night Irrigation Program - NPI. Beyond this discount, the farmer that adheres to NPI will get additional benefits, as completion of the electric grid without cost, subsidized financing of equipment, technical assistance, support with environmental farm compliance, and the possibility of replacing the entire pump energy matrix. As part of the NPI strategy of action, installation of learning centers for irrigation technology was planned in agricultural schools, thus contributing both to improve technical professional training in agriculture, and for the dissemination of knowledge in irrigated agriculture, in order to increase agricultural productivity.

KEYWORDS: family farming, water use, electric energy, vocational training.

INTEGRAÇÃO ENSINO PROFISSIONAL-PESQUISA-EXTENSÃO RURAL ATRAVÉS DE CENTROS DE TECNOLOGIA EM AGRICULTURA IRRIGADA

RESUMO: Com o objetivo de estimular o uso da irrigação e utilizando-se de descontos na tarifa de energia elétrica concedidos por lei federal, em 2004, o Governo do Paraná lançou o Programa de Irrigação Noturna - NPI. Além de descontos, o agricultor que aderir ao NPI contará com outros benefícios, como complementação da rede elétrica sem custo, financiamento subsidiado de equipamentos, assistência técnica oficial, facilitação quanto à adequação ambiental da propriedade, possibilidade de substituição da matriz energética do conjunto moto bomba. Como parte da estratégia de ação do NPI, previu-se a instalação de centros irradiadores da tecnologia da irrigação em vários colégios agrícolas, contribuindo, desta forma, tanto para a melhoria na formação do profissional técnico em agropecuária quanto para a disseminação dos conhecimentos em agricultura irrigada, visando ao aumento da produtividade agrícola.

PALAVRAS-CHAVE: agricultura familiar, uso da água, energia elétrica, formação profissional.

INTRODUCTION

The State of Parana, Brazil, established in 2010 its position as the largest producer of grains in the country, harvesting more than 32 million tons. This accounts for 21.6% of Brazilian production that year (IBGE, 2010), reaching the second place in the national agribusiness export value (MAPA, 2010).

The small portion of arable area of the state using irrigation, about 0.75%, which corresponds to just over 104,000 ha according to data from IBGE (2009), is due mainly to a production system based predominantly on grain crops (corn, soy, beans, wheat), which are cultures with relative resistance to drought, and the good rainfall distribution in the state.

The use of irrigation depends on the economic return of the cultivated crop. In general, given the rainfall distribution in the state, the yield increase of grain crops, and the high cost of the system, irrigation may result in disadvantageous cost/benefit to the farmer. However, irrigation is very beneficial when applied to crops with great response to this practice, low resistance to drought

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and high added value, such as vegetables and spices, as well as fruits and flowers. Recently, the use of irrigation in pastures for milk production has also raised significant interest, because it reduces the critical period of food shortages in the farm, which is of great relevance in milk production systems based on pasture (ROSA, 2004).

Despite the benefits that can be obtained with irrigation, it is necessary to clarify that poorly designed and incorrectly managed irrigation systems can cause negative impacts that compromise their performance. Generally, these impacts mainly affect natural resources (water, soil, wildlife, natural vegetation), and its effects have both social (quality of life) consequences in addition to the economic activity itself.

Considering that the lack of trained labor is one of the most serious problems faced by the farmer, not only with regard to maintenance, but also for the proper operation of the irrigation system, and that there is a need to disseminate the important of this technology, it is necessary to create technology units to train irrigating farmers from different regions, in order to offer alternatives to increase crop productivity, improve product quality, increase the production and the property income (thus, decreasing migration to urban and setting the youth on the farm).

The presence of agricultural schools in different regions of Paraná can be used to achieve the goal by creating irrigation diffusion units in different soil and climatic conditions. Most students in these schools are farmers' children and may return to their place of origin with basic knowledge in irrigation to implement the technique in the family's property, or increase their chances to find jobs.

Here, we describe the concept and foundations of the Night Irrigation Program, as well as the establishment of irrigation technology dissemination centers in vocational agricultural schools in the State of Paraná.

THE NIGHT IRRIGATION PROGRAM IN PARANÁ

The Paraná state government, through SEAB (the State Department of Agriculture and Supply) and Copel (Paraná Energy Company) launched in 2004 the Night Irrigation Program - NPI, which grants via ANEEL (the National Electric Energy agency) reduction of 60% to 70% in the energy fee to farmers who use electricity for irrigation exclusively in the period between 9.30 pm and 6.00 am, along with several other benefits, in order to especially improve farmer's activities with the implementation of irrigation systems. Thus, farmers who join NPI are more capable to increase the productivity of their crops with better cost-benefit arrangements, thus generating a positive impact on the entire chain of the crops involved (FIALHO et al., 2004).

As a general goal, NPI aims to encourage the use of irrigation to increase agricultural production and productivity, promoting increased income and improved quality of life of farmers in the state of Paraná, through the rational use of water and energy power. In addition, NPI aims to: encourage the conversion of existing agricultural systems seeking to increase income, reduce environmental impacts and sustainability of agricultural activities, reduce the amplitude of the curve between supply and demand of vegetable crops in the state during the year, optimize water and energy consumption in food production, develop and adapt irrigation technologies in the state, increase electricity consumption as a result of new production processes and investment in comfort, optimize the assets of the utility energy distribution, and create IATC (Irrigated Agriculture Technology Center in State Agricultural Schools).

Initially, the Night Irrigation Project aimed at reaching approximately 15,000 producers in the state of Paraná in about 30,000 ha. As for the escalation in irrigated area, the program specified an increase of about 20%. Another goal that must be highlighted is the partial replacement of the energy used in irrigation systems currently operating in Paraná. However, with the implementation of the program, some logistic problems prevented the anticipated acceptance by the farmers, including the fact that joining the program implied environmental suitability of the entire property (Sisleg), besides the delay in the installation of the system. It was also necessary to grant water

usage, which meant more cost and delay to granting the permit. Another difficulty was the formation of technical capacity for the program.

Since 2007, the program changed its operational strategy, with simplification and even dispensation of water use permit and environmental licensing. The funds now have specific lines of credit and more attractive interest rates. In addition, the proposed flow of accession to NPI, previously passing through various organs, became more efficient with the EMATER Institute assuming virtually full operational control of the program. With this purpose, several training courses for technicians involved in the program were created by IAPAR (Agronomic Institute of Paraná) as well as the preparation of a manual technical irrigation.

Until December 2010, about 2,000 farmers had effectively joined NPI, with other 600 farmers enrolled and waiting for provisions (work in energy grid, building of service entrance, and other pendant issues).

Even with this current low adherence to NPI in Parana, it is believed that climatic instability, with rainy years alternating with years with predominance of dry spells, may raise farmers' awareness to search for better technologies to minimize their losses during unfavorable weather conditions. The high debt rates of the farmer, even in light of the losses incurred in previous periods, is a major cause for their not joining the program. Efforts to better adherence to the program should be directed to irrigation farmers who use energy and desire to move the opening hours of irrigation to the evening with the simple installation of a specific meter, or for those who wish to change the energy matrix of their systems (from fossil energy to electrical) with minor adjustments of the project and without considerable cost.

THE AGRICULTURE TECHNICIAN IN IRRIGATION

The education of the agricultural techniques is of paramount importance to the practice of the establishment of an efficient agriculture; therefore, to complete their degree in agricultural school, this professional will be able to conduct several activities in the industry working on three key issues: food production, setting the man on the farm, and environment preservation. There are currently about 200,000 professionals in Brazil, and it is estimated that about five thousand technicians of this total work in Paraná.

The profession of agricultural technician, or technician in agriculture, is regulated by the Law n. 5,524 of November 5, 1968 and the Federal Decree n. 90,922 of February 6, 1985, with amendments to the Federal Decree n. 4560, of 30 December 2002, which create and define the duties of agricultural experts in their various skills. Among them, it is the responsibility for preparation of projects and technical assistance in irrigation and drainage with a maximum value of R$ 150,000.00 (one hundred fifty thousand Brazilian reais) per project.

The State of Paraná has 22 agricultural colleges, 19 of them run by the state (SEED, the State Department of Education), one run by the federal system, one private and one connected to the State University of Ponta Grossa (UEPG). Only in this state, approximately 900 new professionals enter the job market each year (SINTEA-PR, 2010). Most of the graduates, being children of farmers, eventually return to their family's properties, and contributing to improve the productivity of the farm, better management and application of technologies.

In Paraná, the Technician in Agriculture program teaches only basic notions of irrigation and drainage as a topic in the Soil discipline. The classes are held in didactic-productive units of the schools, many of them with outdated equipment. Although the majority of irrigation projects are developed by higher education professionals, which minimum program offers courses on irrigation, most often it is these mid-level technicians who, even for economical reasons, lead the implementation of projects and their operation and management.

From the concept that the training of technician in agriculture should not be viewed as a simple free process of certification, but an alternative to the growth of a professional future, it is

justified the proposed increase in education quality through implementation of scientific areas, technical reference through partnerships between educational institutions and extension agencies, and research in order to contribute to the training process.

AGRICULTURE IRRIGATION TECHNOLOGY CENTERS - AITCs

The implementation of observation and research units in irrigated agriculture will turn agricultural colleges into regional references in irrigation management, thus increasing the interaction between teaching units and the rural community, through testing and adjustment of irrigation technologies located under different climates. Moreover, these units are expected to conduct research in irrigated agriculture in accordance with regional aptitude as well as enabling students from these schools to implement and technically monitor irrigation systems. In general, the AITCs aim to:

1. Become centers of technological reference involving three aspects: education (for students of the vocational schools), technicians and farmers (specific training) and innovation (irrigation adapted to distinct areas).

2. Expand students' knowledge in irrigation to make them professionals that are more competitive in the job market.

3. Disseminate information for the understanding of irrigation technology potential, aimed at increasing agricultural production and yield through the training of technicians and farmers in the use of irrigation technologies, with emphasis on reducing the use of electricity and the rational management of irrigation water.

4. Constitute an element of support, interaction and diffusion of irrigation technology.

5. Contribute to improving life quality and the environment in rural areas by the use of natural resources and the replacement of the fossil energy for electricity in the NPI pump system.

For implementation and operation of these centers, a technical cooperation agreement was signed between the financial and public institutions involved in the program and Copel, providing an investment of R$ 1.66 million, including for the purchase and installation of equipment (by Copel) and the dedication of professionals (SEAB and EMATER) and school teachers (SEED).

Considering where the regional conditions where agricultural schools are located, thirteen schools were selected to receive IATC educational units (Figure 1). The location of the units around the state included different conditions in terms of soil, climate and crops.

From the selection of schools, irrigation system projects were prepared for each unit. Given the purpose of using it as a demonstration unit, each project should cover the largest number possible of irrigation systems to enable the students to learn the various alternative technologies, with emphasis on systems that allow more efficient use of water and energy, provide less environmental impact and reduction of production costs. In addition, the project should reflect the regional context, in both the most important existing production chains, as well as potential supply chains, underscoring the viability and sustainability of small farms.

In addition to irrigation projects, the acquisition of automatic weather station was suggested as auxiliary for the implementation of irrigation management, further contributing to the training of students and serving as a regional source of an agrometeorological database.

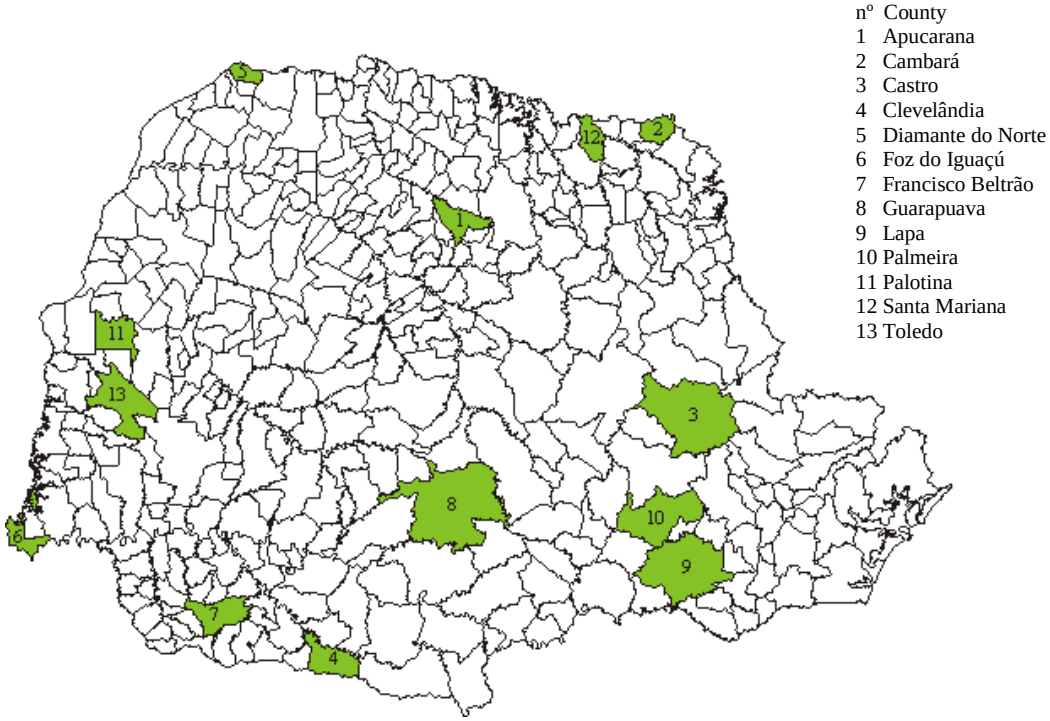

FIGURE 1. Geographic localization of the Professional Agricultural Schools with the IATC in the State of Paraná.

After the development and analysis of technical and economic viability of the projects, equipment for each unit was acquired through competitive bidding. The cost of the projects in each unit of instruction is presented in Table 1. In the same table, it is also shown the number of students in each facility that will educationally benefit from the center with the implementation of technology in irrigated agriculture. The variation in project values is mainly due to the existing infrastructure at each site, requiring different levels of resources to implement the project. From the data of Table 1, it is noticed the purchase of only twelve automatic weather stations, due to the fact that Cleveland agricultural school already had a station that is part of the station network of the Paraná Meteorological System.

TABELA 1. Number of students and cost of the irrigation project in each professional agricultural school.

County	Establishment	Student number	Cost of the project (R$)[(1)]
Apucarana	CAE Manoel Ribas	630	25.950,00
Cambará	CEEPA Mohamad Ali Hamzé	292	28.640,00
Castro	CEEP Olegário Macedo	239	25.874,59
Clevelândia	CEEP Assis Brasil	664	21.400,00
Diamante do Norte	CAE do Noroeste	330	39.350,00
Foz do Iguaçu	CEEP Manoel M. Pena	517	29.800,00
Francisco Beltrão	CEEP do Sudoeste	346	21.450,00
Guarapuava	CEEP Arlindo Ribeiro	340	35.305,00
Lapa	CEEPA da Lapa	162	26.475,00
Palmeira	CAE Getúlio Vargas	289	26.283,88
Palotina	CAE Adroaldo A Colombo	374	29.400,00
Santa Mariana	CAE Fernando da Costa	292	26.536,00
Toledo	CAE de Toledo	396	45.218,00
12 Meteorological Stations			109.000,00
Total		**4871**	**480.682,47**

(1) Values in June /2010.

Table 2 shows some characteristics of the IATC irrigation projects. As previously mentioned, due to the specificities of the Paraná climate, the major irrigation demands are for vegetable crops, fruit trees, and pasture.

TABELA 2. Main characteristics of the irrigation projects in the professional agricultural schools.

County	Characteristics of the irrigation projects		
	Source of water	Sistems[(1)]	Cultures
Apucarana	well / reservoir	dri., micro	horticulture, fruitculture, coffee
Cambará	stream,reservoir	spr., dri., micro	banana, pasture, coffee, corn
Castro	dam, well	spr., dri., micro	horticulture, fruitculture, ornamental
Clevelândia	well / reservoir	spr., dri., micro	horticulture
Diamante do Norte	well	spr.dri.	pasture, fruitculture
Foz do Iguaçu	well	spr., dri., micro	pasture, horticulture, fruitculture, coffee
Francisco Beltrão	River,reservoir	spr.micro	horticulture, medicinal, nursery
Guarapuava	reservoir	spr. micro	horticulture, fruitculture
Lapa	well	spr., dri., micro	horticulture
Palmeira	reservoir	spr., dri., micro	horticulture, fruitculture
Palotina	well	spr., dri., micro	horticulture, fruitculture
Santa Mariana	reservoir	spr., dri., micro	corn, alfalfa, sunflower horticulture, banana
Toledo	river	spr., dri., micro	horticulture, fruitculture

(1) spr.- sprinkler, dri.- dripping, micro- microsprinkler

The problems encountered after the implementation of the projects included improper handling, clogging of emitters, theft of equipment, lack of experience with the practice of technology, and insufficient water flow. Some of these problems could be resolved within the project itself, such as installation of appropriate filters and correct sizing depending on water flow. It was noticed that those responsible for the project were mostly school teachers without much irrigation experience, who needed specific training in order to properly instruct the students. To this end, we aim to provide courses for the teachers responsible for disciplines that cover irrigation practice. Unfortunately, there is a high replacement rate of teachers, who are most often hired on a temporary basis.

For installation and operation of the agrometeorological stations, the company supplying the equipment was required to be responsible to carry out training in schools, what actually happened. With the installation of these stations, it was aimed to create a database that can assist research and extension in the implementation of additional projects and to conduct experiments in irrigated agriculture, serving as centers of diffusion technology in the state.

FINAL CONSIDERATIONS

We expect that with the establishment of irrigation technology diffusion centers in agricultural schools, within the Night Irrigation Program in the state of Paraná, the benefits of irrigated agriculture are propagated as well as technical capacity is formed and trained for system operation and rational water management of irrigation projects.

Thus, this program contributes to better utilization of natural resources in the farms, better use of electricity, increasing agricultural productivity and income, as well as the retention of young farmer's son in the farm.

This initiative can be extended to other states taking into account the particularities of each region, making irrigation systems more professionally operated and managed, thus increasing the potential of agricultural production.

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