

Agriculture and the Environment in Secondary Education in the Philippines: The University of the Philippines Rural High School Experience

Gregorio Y. Ardales Jr.*

Assistant Professor and former Principal of the University of the Philippines Rural High School,
College of Arts and Sciences, University of the Philippines Los Baños,
College, Laguna 4031, Philippines
Currently a PhD Student in Environmental Science, Graduate School,
University of the Philippines Los Baños

In a developing country like the Philippines, it is important to understand the challenges involved in feeding a rapidly increasing population and dealing with environmental concerns, and it is vital to include agriculture and environmental education in the basic curriculum. Agriculture, industrial arts, and entrepreneurship are included in the secondary curriculum of both public and private schools, as prescribed by the Philippine Department of Education, and topics related to the environment are required to be integrated into different subjects being taught in these schools.

The University of the Philippines Rural High School (UPRHS), one of the basic education units of the University of the Philippines (UP), was originally established as a vocational agricultural school. Historical events as well as outstanding developments in the UP College of Agriculture (now UP Los Baños) led to the evolution of UPRHS from a vocational school to a science-oriented college preparatory high school. The school continues to offer agriculture as one of the major subjects for all grade levels. The students are encouraged to undertake research projects addressing agricultural and environmental issues.

In support of its science and agriculture programs, the UPRHS maintains a strong connection with UP Los Baños and other nearby research institutions. The school also sends participants each year to the Asian Agricultural High School Student Exchange Program sponsored by Gunma Prefecture, Japan. The UPRHS aims to popularize its agriculture and environment-related programs through academic requirements, co-curricular activities, and community-based involvement.

Key words: University of the Philippines Rural High School, Agriculture, Environmental Education

Introduction

Education is a key for attaining sustainability. Research has proven that education is effective in improving agricultural productivity, reducing population growth rates and enhancing environmental protection. However, in order to achieve sustainable targets, basic education institutions should reorient their curricula to focus on skills, values and

perspectives that promote public participation and community decision making. Basic education must also seek to develop students' skills of critical thinking, organizing and interpreting data and information, formulating questions and analyzing issues that confront communities (McKeown, 2002).

As the world is confronted with the challenge of feeding a rapidly increasing population as well as serious environmental problems, it is vital to inte-

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* Corresponding author: University of the Philippines Rural High School, College of Arts and Sciences, University of the Philippines Los Baños, College, Laguna 4031, Philippines.

Tel: 634 9573 0093, Tel/Fax: 634 9536 2437, E-mail: gardalesjr@yahoo.com

grate agriculture and environmental education into the basic education curriculum, especially in developing countries.

In this paper, I discuss the importance of teaching agriculture and environmental education, how these subjects are taught at the University of the Philippines Rural High School (UPRHS), and how student research projects complement agriculture and environmental education at UPRHS.

Basic Education in the Philippines

In the Philippines, basic education is composed of six years of elementary school and four years of high school. This is administered by the Department of Education. For both public and private schools, the school year starts in June and ends in March, with about 40 weeks of instruction. Elementary education is compulsory and free in public schools, where about 90% of all students are enrolled. Public high schools are also free and account for about 68% of total enrollment (Clark, 2004). Children who enter elementary school at age 6 are expected to finish high school at age 16, which is younger than students in other countries with more years devoted to basic education.

There are two basic curricula in Philippine secondary schools: general and vocational. General high schools offer a general education program that can qualify students for tertiary education. Practical subjects such as agriculture are offered together with industrial arts and entrepreneurship as one of the components of *Makabayan*¹ (Department of Education, 2002). Vocational high schools emphasize vocational skills training and practical education. In addition to the required academic subjects taken by general high school students, technical and vocational subjects in the fields of agriculture, fisheries and trade are offered. The first two years are devoted to a general vocational area, and then students specialize in a specific discipline during the last two years (Clark, 2004). Like graduates of general secondary schools, graduates from vocational high schools may qualify for tertiary education.

In addition to the general and the vocational high schools, there are also science high schools for stu-

dents who have demonstrated great competence in science and mathematics (Clark, 2004).

The Importance of Practical Subjects in Basic Education

Bergman (2003) reported that the Western-type education introduced to developing countries was too academic and did not prepare children for real-life situations after school. Thus, children in developing countries require an education that would help to improve their life skills and lead to jobs with decent compensation and benefits.

Practical courses such as agriculture, industrial arts, and entrepreneurship are offered in general high schools in the Philippines and are given equal importance with other academic subjects. By offering practical subjects, general secondary schools aim to develop knowledge, skills, values, and attitudes that will help prepare students for higher learning or employment. These subjects provide both theoretical and practical experiences for students to develop their capabilities in building their own livelihood (Department of Education, 2002).

Practical training is an important component of agricultural education. The practical training models adopted in Philippine agricultural education are based on the interactions of three basic principles of learning: the principle of practice, the principle of association, and the principle of effect. The integration of these principles results in experiential learning (Mancebo, 1995).

The Importance of Agricultural Education

Agricultural education institutions are in a strategic position to address the increasing challenges that are closely tied to food and agriculture (National Research Council, 2009). The education of agricultural professionals should focus on how to attract and retain students who are not only interested but also capable of handling the complexity of modern agriculture. Other concerns include devising a relevant curriculum and delivering the various topics so that students acquire an interdisciplinary appreciation of the field (Dunn and Wolfe, 2001).

In the Philippines, the challenges in agricultural education include the rapid increase in population;

¹A major subject area in the Department of Education curriculum composed of social studies, technology, livelihood and home economics, music, arts, physical education, health, and values education.

the conversion of prime agricultural lands to industrial, residential, and other conflicting land uses; increasing agricultural productivity; and attaining self-sufficiency. The country's agriculture education needs to attract and retain future agriculturists and agricultural educators and provide them with relevant training.

The Importance of Environmental Education

Environmental education has been defined as "the process of recognizing values and clarifying concepts to develop skills and attitudes necessary to understand and appreciate the interrelatedness among men, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality" (IUCN, 1970; cited by Sato, 2006). Environmental education aims to provide people with the knowledge needed to develop a sense of responsibility toward the environment and promote rational utilization of its riches (<http://www.emb.gov.ph/eeid/enviroeduc.htm>).

Acknowledging the importance of environmental education, the Philippine government enacted Republic Act (RA) 9512, also known as the Environmental Awareness and Education Act of 2008, which mandates the promotion of environmental awareness through environmental education by integrating environmental education into all levels of the school curriculum (<http://www.senate.gov.ph>). Similar laws have also mandated the integration of environmental issues into the curriculum. Among these are RA 9003, the Ecological Solid Waste Management Act of 2000 (<http://lawphil.net>), and RA 9729, the Climate Change Act of 2009 (<http://www.klima.ph>).

The UPRHS

The UPRHS is one of four basic education units maintained by the University of the Philippines (UP) system. The school is located in the municipality of Bay in Laguna Province, which is about a 10- to 15-minute ride from the main campus of the UP Los Baños. The school grounds occupy approximately 4.1 ha. As a basic education unit under the UP, the UPRHS performs three basic roles, serving as (1) a laboratory school for student teachers in agricultural education before, and now

in math and science teaching; (2) a service school for dependents of UP personnel; and (3) a source of students for the different degrees offered by the UP (Padolina, MCD *et al.*, 2007, unpublished report submitted to the UP president).

The UPRHS was administered by the Department of Agricultural Education and Rural Studies in the College of Agriculture from the start of its operation in 1929 until 2003, when it was transferred under the jurisdiction of the College of Arts and Sciences of the same university.

History of the UPRHS

The UPRHS was established as a vocational (agricultural) high school by virtue of the Philippine Legislature Act 3377, approved on December 3, 1927, and the school began operating on June 10, 1929. It was placed under the administration of the Department of Agricultural Education to serve as a laboratory for the observation and practice of candidates for the Certificate in Agricultural Education. Historical events in the country and the outstanding developments in the UP College of Agriculture (now the UP Los Baños) led to the evolution of the UPRHS from a vocational school to a college preparatory high school in the 1960s and ultimately to a science-oriented college preparatory high school in the mid-1970s (Lagasca, 1984).

According to Lagasca (1984), the development of the UPRHS's curriculum can be divided into three stages: the vocational stage (1929–1960), the college preparatory stage (1960–1974), and the science-oriented college preparatory stage (1974–present). The subjects in the vocational curriculum of the school (Table 1) focused mainly on training students in the rudiments of farming, with an additional 19 hours per week devoted to hands-on experience aimed at developing the various skills required. Table 2 summarizes the significant revisions in the curriculum that affected agriculture courses offered as the school transformed from a vocational to a science-oriented preparatory high school.

The UPRHS performs regular reviews of its curricular and co-curricular offerings to make them more attuned to the present needs. In addition to curriculum development, school policies regarding the grading system, admission, and student conduct are continuously reviewed to provide a holistic sec-

Table 1. List of subjects in the 1929 vocational curriculum of the University of the Philippines Rural High School

| First Year | Second Year | Third Year | Fourth Year |
|---|--|--|---|
| Literature Current events Composition Algebra Horticulture Field work (gardening) Physical education and group games | Literature Composition Biology Geometry Animal husbandry Field work (raising poultry and swine) Physical education and group games | Literature and composition Current events General history Advanced algebra Pests and diseases Farm crops Field work (lowland and upland farming) Physical education and group games | Literature and composition Current events U.S. history, Philippine history and government Physics Farm economics Field work (shop, carpentry, and general service for boys; assisting in the laboratory, infirmary, and other departments for girls) Physical education and group games |

Note: There is a total of 23.5 units broken down into English (5 units), mathematics (2.5 units), history (2 units), biology (1 unit), physics (1 unit), agriculture (4 units), field work (19 hours per week; 4 units) and physical education (4 units).

Source: Modified from Lagasca (1984).

Table 2. Changes in the curriculum from vocational to science-oriented college preparatory that affected the teaching of agriculture at the University of the Philippines Rural High School

| Period/Year | Nature of Change |
|--|---|
| Vocational Curriculum (1929-1960) | Institution of farm business arithmetic in 1942, during the Japanese Occupation, which was abolished after World War II Adoption of separate curricula for boys and girls |
| Transition to College Preparatory (1960-1974) | Reduction in the amount of field work from 19 to 9 hours per week Merging of the boys' vocational curriculum and the girls' home economics curriculum into a single, college-preparatory curriculum. However, boys continue to have more agriculture instruction and girls more home economics instruction at all levels |
| Transition to Science-Oriented College Preparatory (1974-1984) | Students were required to conduct simple research projects either individually or in groups as part of their science course Since 1979, agriculture and home economics have been offered only for 4 hours a week. Agriculture was taught as a science instead of just a vocational subject. Links were established with UP Los Baños units and nearby research institutions to strengthen the school's program, particularly in the field of student research |

Source: Lagasca (1984).

ondary education program at the UPRHS.

Benchmarking with the Department of Education Curriculum

The UPRHS is not required to comply with the curriculum prescribed by the Department of Education because it is under the direct supervision of UP Los Baños. Curricular proposals from the faculty of UPRHS are reviewed by the faculty at the college level, then the university council of UP Los Baños, and finally by the Board of Regents of the UP system.

The school offers subjects that are not included in

the curriculum prescribed by the Department of Education for public and private high schools. Table 3 lists the subjects offered at UPRHS and those prescribed by the Department of Education with the corresponding unit credit and number of hours allotted per week for all the four year levels. Compared to the Department of Education curriculum, the school continues to maintain separate English and literature classes for three year levels. It devotes more time to science courses and offers a separate class in research. The UPRHS also offers a comprehensive mathematics program, which includes basic, intermediate, and advanced algebra,

Table 3. Comparison of the subjects offered at the University of the Philippines Rural High School (UPRHS) and the prescribed secondary curriculum of the Department of Education, with corresponding total unit credit and total number of hours allotted per week for all the four year levels

| Subject | UPRHS Curriculum | | Department of Education Secondary Curriculum | |
|--|--|---|---|---|
| | Total unit credit for all four year levels | Total hours per week for all four year levels | Total unit credit for all four year levels | Total hours per week for all four year levels |
| Science | 8 | 24 | 6 | 20 |
| Research | 1 | 3 | Not required | |
| Math | 5.5 | 16.5 | 6 | 20 |
| Computer science | 1.5 | 4.5 | Optional (Some schools integrate Information Technology in the Technology, Livelihood and Home Economics subject) | |
| Social studies* | 4 | 12 | 4.8 | 16 |
| Filipino | 4 | 12 | 6 | 20 |
| English | 4 | 12 | 6 | 20 |
| Literature | 3 | 9 | Integrated in English subjects | |
| Agriculture/home economics (for UPRHS) Technology, livelihood, and home economics (for the Department of Education)* | 4 | 16 | 4.8 | 16 |
| Physical education, music, Scouting (for UPRHS) Physical education, music, arts, health (for the Department of Education)* | 4 | 12 | 4.8 | 16 |
| Homeroom/values education* | 2 | 6 | 1.6 | 4 |
| Citizenship Advancement Training | 1 | 3 | Optional | |
| Total | 42 | 130 | 40 | 132 |

* These subjects are offered separately at the UPRHS but are integrated into *Makabayan* in the Department of Education curriculum.

Source: UPRHS curriculum 2010 and the Department of Education (2002).

modern geometry, trigonometry, calculus, and statistics. The school also offers computer courses in the first and second year. Agriculture and home economics courses are offered as separate subjects. Music and physical education are offered as separate subjects in each of the four years. Health is integrated into science and home economics classes. Scouting (Boy Scouts/Girl Scouts) is maintained in the first year, while the course Citizenship Advancement Training (formerly Citizen Army Training) is offered in the fourth year. Despite these variations, there is not much discrepancy between the UPRHS and Department of Education curricula in the total number of credit units and in the number of hours allotted each week in the four years.

The academic year is divided into four grading periods. However, the school follows the academic

calendar set by the UP Los Baños instead of that prescribed by the Department of Education.

The Teaching of Agriculture at the UPRHS

Agriculture remains one of the subjects of major importance at the UPRHS, and it is considered to be an application of the different science courses offered during the four years. Agricultural training is allotted four hours a week, divided into two hours for classroom discussion and two hours for field or laboratory activities (Figure 1).

Boys are enrolled in agriculture classes for three grading periods during the four years, while girls study home economics. During the first grading period of each year, however, boys take home economics classes while girls study agriculture.



1a



1b



1c



1d

Fig. 1. Various activities of agriculture classes at the University of the Philippines Rural High School: (a) rice planting; (b) traditional dressing of chicken; (c) making salted eggs; and (d) woodworking.

Agriculture I

Fundamentals of Crop Production is offered during the first year. Theoretical discussions cover the principles and various practices employed in producing crops. As the students' first agriculture course, this class introduces the history and importance of agriculture as well as the branches and fields of specialization. Field and laboratory activities include growing various crops in the field, growing vegetables in containers, Simple Nutrient Addition Program (SNAP) hydroponics, plant propagation techniques, rice planting, soil sampling and soil fertility testing, experiments and table-top activities.

Agriculture II

Introduction to Animal Production is offered during the second year. Class discussions start with the familiarization of different species and breeds of poultry and livestock, the external parts of these animals, and the terminology used in animal production. Basic principles in animal nutrition, breeding and reproduction, and health and sanitation are discussed before proceeding to discussions on poultry, swine, cattle, and carabao (water buffalo) production. Field and laboratory activities include raising poultry (chicken, turkey) and swine, experiments and table-top activities.

Agriculture III

Agricultural Product Processing is offered during the third year. The course is divided into plant-based and animal-based product processing, which are allotted one grading period each. To boost the students' entrepreneurial skills, the last grading period is devoted mostly to processed agricultural products in small-scale businesses. Laboratory activities include the processing of various products, and field activities are performed as needed. Part of the final grading period of Agriculture III consists of lectures on current trends in agriculture, including topics such as sustainable agriculture and agroforestry systems.

Agriculture IV

Introduction to Agricultural Mechanics is offered during the fourth year. The course offers students experience in engineering, project planning, technical drawing, use of hand and power tools and

power machines, engineering materials, soldering and electric arc welding, basic farm and home electrification, plumbing materials, water pumps and systems, farm power and machinery, and power and energy. The laboratory component is purely project based and the projects may be classified under wood work, metal work, or concrete work.

In all four levels of agriculture courses, classroom instruction is supplemented with video presentations, invited speakers, demonstrations, and field trips to the Dairy Training Research Institute, Philippine Carabao Center, and other farms in the vicinity. Aside from learning the rudiments of agriculture, other equally important objectives of the agriculture courses are to help the students develop life skills, appreciate the value of work, and become self-reliant, responsible, and productive citizens.

Furthermore, the Filipino Agricultural Scientists of Tomorrow (FAST), a student organization under the supervision of the school's Agriculture Department, assists the department in promoting the importance of agriculture among UPRHS students. FAST members also help to maintain and develop the school demonstration farm through fundraising activities and voluntary service. Together with the Home Economics Club, FAST organizes the annual HE—Aggie Fair and Exhibits, which aims to promote the relevance of both subjects by featuring various projects and skills learned in the different agriculture classes. This is also a venue for extension seminars for farmers on relevant topics in both crop and animal production (Figure 2). Hog vaccinations and the anti-rabies campaign are also conducted during the fair, as part of the school's outreach program. Through the Agriculture Department and FAST, the UPRHS maintains linkages with local government units and private institutions in support of these projects.

The UPRHS also has been participating in the Asian Agricultural High School Student Exchange Program hosted by Gunma Prefecture, Japan, since 1998. Selected students from Indonesia, Malaysia, Mongolia, the Philippines, and Thailand are given the chance to study at the Seta Norin (Agricultural and Forestry) High School and in other agricultural high schools in Gunma Prefecture for 10 months. For the past years, the UPRHS sends three students

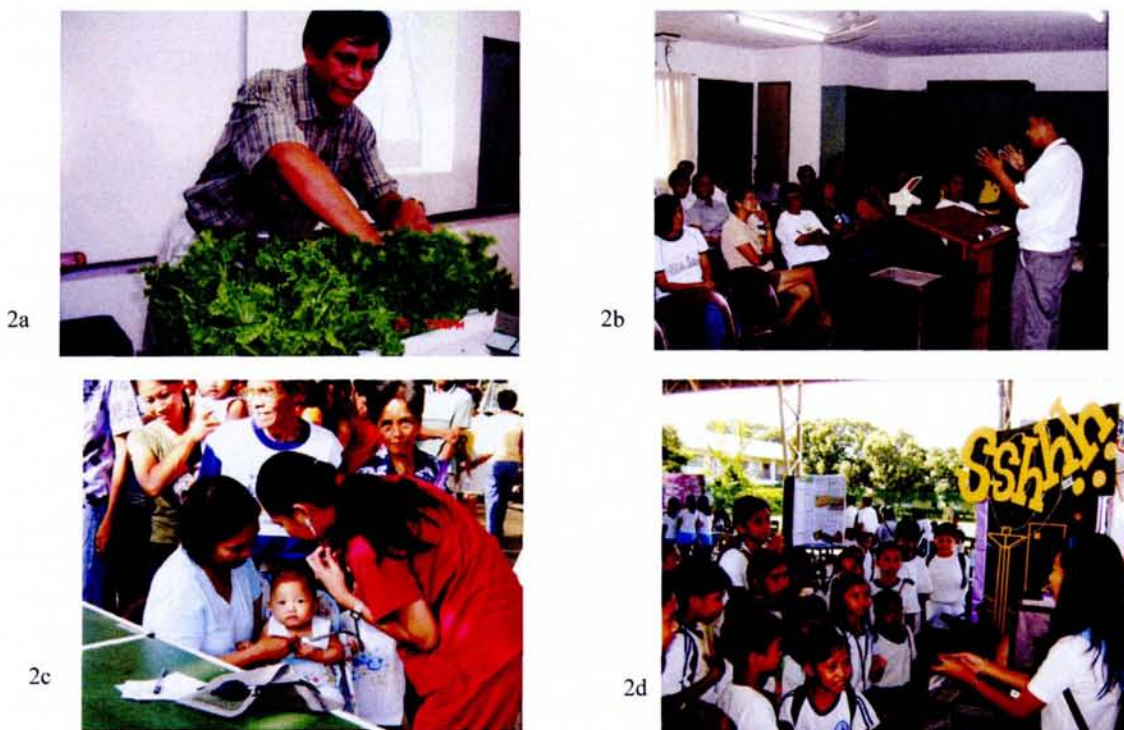


Fig. 2. Extension activities sponsored by the University of the Philippines Rural High School: (a) demonstration on SNAP hydroponics by an expert from the Institute of Plant Breeding, UP Los Baños; (b) “Prevention of Common Swine Diseases” seminar by an expert from San Miguel Foods, Inc.; (c) Medical and Dental Mission for indigent families of nearby communities; and (d) Annual Science and Math Fair and Exhibits.

to participate in the program. These students study agriculture and may specialize in any of the following fields: plant science, biotechnology, resourced animal science, applied animal science, civil engineering, landscape design, food science, food business, flower design, and green life (Seta Norin School Information, 2007). Students are also required to study the Japanese language, and they get to experience Japanese culture through a home-stay program, interactions with students, study tours, and other activities.

Integrating Environmental Education at the UPRHS

Discussions of the environment as well as current environmental issues and concerns have always been a significant part of science and agriculture courses at the UPRHS. Currently, environmental education is integrated into many subjects offered at the school, including not only science and agriculture but also social studies, English, Filipino, literature, home economics, and Scouting.

The topic of living things and their environments is part of the general science course. Students are introduced to the problems of pollution and climate change as part of discussions on the hydrosphere, atmosphere, and weather and climate, as well as renewable and nonrenewable energy sources. A better understanding of ecology is provided during their second year as part of the biology class.

Class discussions are supplemented with the following activities: a debate on population control, group discussions on how students can help solve certain environmental problems, sharing photographs of situations depicting interactions of living things, creating a three-dimensional model of a technology that would help maintain ecological balance using creative and imaginative thinking, reading articles on the impact of chemistry on the environment, creating posters highlighting environmental issues, participating in contests and seminars with themes on the environment, writing reflections on how students can take care of the environment, watching films and documentaries on envi-

ronmental issues, taking field trips to different types of ecosystems to observe interactions between and among living and nonliving components, and answering questions on how they can apply the ecological concepts learned to their homes and communities.

Alternative methods in crop and animal production are discussed in Agriculture I and II, respectively. The impact of inorganic fertilizers and pesticides are taken up in the discussion of soil fertility and pest management. The importance of organic fertilizers and other methods to build up organic matter in the soil are emphasized in classes and applied in the field. Alternative methods of pest management, such as biological control, proper cultural management practices, and use of resistant varieties, are promoted in place of the conventional use of pesticides. The advantages of a diversified cropping system over monocultures are also emphasized. The choice of the right breed of animals to raise, proper nutrition, and appropriate management practices are highlighted in animal production classes. Alternative feeds and traditional management practices are employed in raising native chickens and, to a certain extent, in raising hogs. The animals raised on the school farm provide manure that is an important component of compost used for growing crops.

Aside from science and agriculture instructors, teachers in other subjects also integrate environmental issues and concerns into their subject areas. For example, in Social Studies II, lessons on Philippine demography include population size and its implication for resource use. Environmental issues and concerns are also discussed as some of the contemporary problems of the country. Students are also asked to report on current events, and some of the reports involve environmental issues and concerns.

In Filipino class, articles and stories with themes on the environment are used to test listening skills (including comprehension and vocabulary) of the students. This is accompanied by group discussions on experiences related to the topic and application to real-life situations. In literature classes, environmental issues are included in some of the selections. Teachers are testing the use of eco-criticism in analyzing literary works.

Food safety has always been a major topic in

home economics courses. Students are introduced to alternative food sources and encouraged to discover alternative food preparation methods. The recycling (conversion to other useful products) and redesigning of clothes (fashion updating) are also part of their lessons. The use of waste materials is encouraged in making projects in home economics.

A concern for nature has always been part of the Scouting program. Both Boy and Girl Scouts are involved in projects such as tree planting and community cleanup drives, especially during their camping activities.

The Student Research Program

The knowledge gained by students from agriculture and environmental education at UPRHS is enhanced by research projects. A criterion in the selection of research topics is relevance to the current issues and many students conduct research projects related to agriculture and the environment.

Conducting research projects has been a requirement in Science III (chemistry) since the 1970s. This started the school's participation in regional, national, and international science competitions. Throughout the years, several UPRHS student research projects have won awards at these competitions.

In the mid-1990s, a separate course in techniques was instituted through the efforts of the school's principal, Dr. Leonido R. Naranja. This course was offered during the second semester of the second year and the first semester of the third year. Outstanding student research projects were compiled in the UPRHS Journal of Student Scientific Research entitled *SCIRES*. Unfortunately, the school only published three volumes of this journal; two volumes were released during Dr. Naranja's term in 1996 and 1997, and the third was published during the term of Prof. Liza C. Carascal, in 2001.

The UPRHS sponsors an annual Local Science and Math Fair and Exhibits. This event is spearheaded by two student organizations, the Delta Theta Epsilon Science Society and the AlGeoTriCS (Math Club), which are supervised by the Science and Mathematics Departments, respectively. The fair serves as a venue for the presentation of student research and the selection of outstanding projects that will be included in higher level competitions. Table 4 lists the outstanding projects chosen

Table 4. Ten outstanding research projects presented at the 2008 and 2009 Local Science and Math Fair and Exhibits held at the University of the Philippines Rural High School

| Title | Student Researchers |
|--|------------------------------|
| 2008 | |
| Exploring the Antimicrobial Activity of <i>Euphorbia hirta</i> L. against <i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , and <i>Escherichia coli</i> | Tambalo, Bacalangco, Dorosan |
| Comparison of Two Isolates of Papaya Ringspot Virus in Affecting the Level and Severity of Symptoms in Different Growth Stages of Davao Solo Papaya | Agramon, De Juras, Reyes |
| Efficacy of Various Plant Extracts in Combination with Coconut Milk Against Dengue Mosquito Larvae (<i>Aedes aegypti</i>) | Ebora, Bombay, Macuroy |
| Optimized Medium for Mycelial Production of <i>Ganoderma lucidum</i> | Ecito, Mananghaya Tomias |
| Detection and Quantification of the Survival of the Pathogens of Rice Sheath Diseases in the Soil Using Baits | Castilla, Sumadsad |
| Optimization of Growth Medium and Fermentation Conditions of Protease Production of <i>Pediococcus acidilactici</i> AA5a | Ilaa, Jamias, Lazo |
| Lichen Growth and Localization: Environmental Air Pollution Indicators in Alabang, Luneta, and Los Baños | Fajardo, Vega, Chua |
| Yoghurt Production Using Carabao's Milk and Alternative Probiotic Starter Cultures | Besares, Maningas, Resol |
| Wood Vinegar as Potential Insecticide Against Green Leafhopper (<i>Nephotettix virescens</i>) and Brown Plant Hopper (<i>Nilaparvata lugens</i>) | Magsino, Alcantara |
| Effects of Tamarind Extract on Mango Anthracnose (<i>Colletotrichum</i> sp.) | Aguilar, Olivera, Pangilinan |
| 2009 | |
| Body Coloration Enhancement and Masculinization of Blue Ahli Fish (<i>Sciaenochromis ahli</i>) Using Methyltestosterone Hormone | Salac |
| Salt Tolerance of Four Crop Varieties of Sweet Sorghum <i>Sorghum bicolor</i> (L.) Moench Treated with Aspirin (Acetylsalicylic Acid) | La Torre, Cruz, De Guzman |
| In Vitro Inhibition of Fungal Isolates Against <i>Rhizoctonia solani</i> Kuhn | Cuadra, Estrella, De Borja |
| Ethanol Production via Enzymatic Saccharification and Yeast Fermentation of <i>Jatropha curcas</i> Hull, a Cellulosic Waste Material of Biodiesel Production | Ortiz |
| Efficacy of Vermicompost Tea as Biocontrol Agents of Fungi in Plants | Manuel, Santos, Tapang |
| Resistance Test of Local Lactic Acid Bacteria to Common Antibiotics and Antimicrobial Properties of Plant Extracts | Castillo, Mojica, Lapastora |
| Initial Study on the Potential of <i>Yautia</i> sp. as a source of Bio-ethanol for the Philippines | Paras, Rivera, Aguinaldo |
| Cytotoxicity Test of <i>Euphorbia hirta</i> L. Crude Extract on Myeloma Cells | Angeles, Abasolo, Escasura |
| The Antibacterial and Antifungal Activity of <i>Jatropha curcas</i> Stem Latex on Selected Bacterial and Fungal Isolates | Genosa |
| Mortality Test on the Exposure of the Common Cutworm, <i>Spodoptera litura</i> , to Bt Corn <i>Zea mays</i> | Oleta, Mapiscay |

at the fair over the last two years. Most of these projects are related to agriculture and/or have environmental significance.

In addition to deepening the students' appreciation of agriculture and the environment, the student research program serves as an avenue to develop their ability to think critically, organize and interpret data, formulate questions, and analyze issues that confront their communities.

Challenges in Teaching Agriculture

Although agriculture has been offered since the establishment of the UPRHS, there are still several problems that need to be addressed.

The fast turnover rate of teachers due to stringent rules on tenure and promotion is one of the major concerns not only of the Agriculture Department but of the whole school. Because the UPRHS is part of the UP system, faculty members are subjected to the same requirements for tenure and promotion as those at the college level. High school teachers are required to pursue an advanced degree within a prescribed period of time. To be eligible for tenure, teachers must publish an article in a peer-reviewed journal within three years after finishing their advanced degree. Promotion is also based on the number of publications credited to a faculty member. This should not be considered as a problem, however, but viewed as a challenge by the faculty and school administration. To address this challenge, teachers are encouraged to pursue advanced degrees and to have their theses or dissertations published in peer-reviewed journals. Teachers are also encouraged to do classroom-based research or to find a mentor from among the seasoned faculty members in the UP system, in order to foster their research potential.

Many students who enter the UPRHS have not yet acquired sufficient basic life skills and are not used to working, especially in the field. Some do not even know how to use simple garden, cleaning and kitchen tools, although most of them are willing to learn. Teachers in agriculture and other practical subjects are expected to provide the necessary interventions to develop the needed skills among these students through proper motivation and supervision.

The UPRHS also suffers from a lack of resources, which may be a common problem among schools

run by the Philippine government. The school's animal demonstration farm, for instance, has been constructed with only minimal financial support. Materials used to construct animal housing were from old structures that were vacated during the school's transfer to its new site. Other materials were requested from the university and taken from old buildings that were demolished. Improvements in the farm are made possible through fundraising activities done primarily by the FAST Club and from the proceeds raised by the annual HE—Aggie Fair. Repairs and minor improvements are done by students as part of the activities of FAST or agriculture classes. Field operations are mostly manual due to a lack of machinery and the high cost of mechanized farm operations. Raising animals is funded by contributions from students and parents. Much of the harvest is given back to students, while some is processed, cooked, and shared during the HE—Aggie Fair Harvest Festival (Saya-Salo). Therefore, teachers at the UPRHS are challenged to devise new ways to effect improvements in these teaching facilities as well as to come up with activities that are relevant but require few resources.

Finally, very limited time is allotted for the discussion of current trends in agriculture. Such topics should be included not only in the third year but during all years to broaden the students' perspective on advancements in agriculture as well as the role of agriculture in attaining sustainable development.

Challenges in Integrating Environmental Education

With the integration of environmental education in the UPRHS curriculum, there are still some concerns that need to be addressed.

Unfortunately, environmental education is not included as a priority in the homeroom (values education) program of the school. This would provide a vital opportunity to effect the necessary changes in the attitude of students toward the environment. The homeroom program of the UPRHS should be revised to include environmental education as one of its priorities.

Some teachers might be hesitant to integrate environmental issues in their respective subject matter due to the lack of necessary knowledge on such issues, the lack of reference materials, and the lack

of training on the appropriate strategies to use. This should be given priority in the school's faculty development program.

The school still has to develop a comprehensive program on environmental education. Although environmental education has been integrated into some subjects at the UPRHS, it is important to have a program that encompasses not only the courses offered but also the co-curricular activities of the school. Involvement of both students and teachers in environmental issues should be further encouraged through active participation in seminars, workshops, conferences, and other forums that deal with environmental concerns. Priority should be given to projects of student organizations that have environmental significance. This should be made a priority in the next program review of the UPRHS and in the planning workshop of student organizations.

Challenges Related to Student Research

With regard to student research, an immediate concern is the lack of proper documentation. It is strongly recommended that *SCIRES* be revived to provide a venue for the dissemination of outstanding student research projects. Efforts should also be made to have the articles reviewed by experts in that particular field.

At present the responsibility of mentoring and supervising the students in conducting experiments and field studies is given to the teacher of the research course. There should be active involvement of other teachers in the student research process in order for the students to further develop their research potential. Research in other fields, such as the social sciences and languages, should be encouraged and sustained to assure the active participation of other teachers.

Conclusions

The role of agriculture and environmental education will become increasingly relevant as we aspire to achieve sustainable development. Despite its transformation from a vocational to a science-oriented high school, the UPRHS continues to promote agriculture as one of its major subjects. The purpose of offering agriculture is not only to teach the principles and practices in animal and crop production but to equip the students with life skills

and to prepare them to become productive citizens.

Although environmental education has been an integral part of science and agriculture courses, efforts are being made to extend this subject to other courses as well. Student research projects have been instrumental in deepening the students' knowledge of agricultural and environmental issues.

Despite the challenges in teaching agriculture, integrating environmental education across the curriculum, and administering the student research program, the UPRHS should continue to develop these fields in order to train future agents of sustainable development in the Philippines.

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