HARAMAYA UNIVERSITY

Policy Brief
ENGLISH

POLICY BRIEF - 1-1
March 2020

THEME

I

Solar Powered Irrigation Pumps are Economically Feasible and Environmentally Friendly Systems than Diesel Pump System

Abebe Debele, BiranuKindishish, Arus Edo and Asmamew Getu

Key messages

Solar powered irrigation pumps are feasible and desirable technological solution to improve farmer livelihoods instead of the expensive and carbon emitting diesel pumps currently in use at Haramaya district.

Introduction

Agriculture in Ethiopia is vulnerable to weather-related shocks due to continued dependence on rain fed production. Irrigation is a proven means to improve production and productivity. The source of irrigation water could be either surface or underground. In east Hararghe underground water is the main source of irrigation. In addition to water availability, energy and pumping technologies remainvital for irrigation. Water pumping consumes a lot of energy during irrigation which demands a significant/substantial expenditure of electricity or energy from diesel. Due to ever increasing fuel cost and their great share in environmental pollution, renewable energy sources particularly solar Photovoltaic (PV) has received much attention. Hence, this study was conducted with the aim of evaluating the technical, economic and environmental feasibility of solar powered irrigation pump over diesel-based pumping system.

Approaches and results

Both primary and secondary data were collected. The economic viability between solar and diesel pumps was analyzed using life cycle cost of 20 years for each system on one hectare of land using PVGIS, CROPWAT 8.0 and New_LocClim_1.10. The price data from equipment suppliers, sample tenders, surveys, farmers and other key informants were collected for a number of technologies and data were compared with regional and international costs for validity. As shown on Table 1, solar based pumping system has significantly higher initial investment cost compared to the diesel-powered pumping system. The operation, maintenance and fuel costs are higher for the diesel pumping system. The comparison revealed that in 20 years of life time the total cost of solar pump system is much lower than the cost of diesel pumping system.

Table 1. The cost comparison of solar pump system (SPV) and diesel pump system(DPS) using 20 years life cycle cost (LCC) for Haramaya district

Costs Breakdown ($)	Solar Pump System ($)	Diesel Pump System ($)
Initial Investment Cost (IIC),	1391.52	315.00
Maintenance and Operation Cost (MOC)	278.30	1200.00
Energy Cost (EC)	0.00	11242.00
Replacement Cost (RC)	478.40	300.00
Salvage Value (SC)	29.60	45.00
Life Cycle Cost (LCC)	2118.62	13012.00

Recommendations

Promotion and awareness creation of solar powered irrigation pump should be made through agricultural extension and rural electrification offices. Since the initial investment cost of solar pumping system is high, there should be a concerted effort to promote credit availability for smallholder farmers through Rural Saving and Credit Organizations, NGOs and pertinent government offices.

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1. Animal Production and Health
2. Plant Production and Health
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3. Energy Resource Development and Utilisation
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4. Mathematical Research

POLICY BRIEF - 1-2 | THEME | I

March 2020

Salinity of Drinking Water has No Effect on Performance and Health of Small Ruminants in the Short Term

Hirut Yierga and Mengistu Urgae

Key Messages

Among the five Rift Valley lakes studied, except Shala the salinity levels of other lakes were better tolerated in mature than growing animals, and in sheep than goats.

Introduction

Livestock requires adequate and good quality drinking water for satisfactory production and health. Inadequate and poor-quality water supply reduces feed intake, water intake and body weight. Climate change in terms of uncertain rainfall and increased temperature may reduce water availability and quality. Salinity is the principal factor determining suitability of water for livestock. The use of water with high salinity levels for livestock consumption is becoming common in many parts of the world. Drinking excess saline water interferes with animal performance and health. However, tolerance to salinity varies with species, breed and age. This study was carried out in the rift valley lakes in Ethiopia to evaluate the effects of salinity of drinking water on sheep and goat performance and health.

Approaches and Results

Quality of water was evaluated from five Ethiopian Rift Valley lakes (Beseka, Chamo, Hawassa, Langano and Shala). Lake Chamo, Langano and Hawassa are brackish while lake Beseka and Shala are saline. The results revealed that in water of all the lakes, concentrations of magnesium, calcium, nitrate and zinc were within the limits but, alkalinity, salinity, levels of sodium, potassium, chloride and bicarbonate ions in water of Lake Shala, and levels of iron, cadmium, chromium, copper, manganese and total coliform count (TCC) in all the lakes were beyond the maximum tolerable levels in drinking water for ruminants (Table 1).

Table 1. Lake water quality (mean; mg/l) and their comparison with guidelines.

Items	Lakes					Standard	> Guidelines (%)
	Awassa	Beseka	Chamo	Langano	Shala		(total sample=29)
Magnesium	13.1	0.312	11.5	1.86	0.101	100	0.0
Calcium	5.8	1.89	6.27	4.23	4.58	200	0.0
Nitrate	2.6	5.53	9.3	3.24	7.32	44	0.0
Zinc	0.619	1.71	1.74	1.66	1.7	25	0.0
Alkalinity	219	774	456	377	5590	1000	20
Total dissolved solids	513	2214	1004	1139	14941	10000	20
Potassium	12.3	15.5	8.96	10.3	123	20	20
Bicarbonate	27.5	109	102	55	1315	1000	20
Chloride	30.2	307	108	159	1586	300	27
Sodium	113	453	297	201	1721	300	53
Chromium	2.48	1.8	1.37	1.8	1.47	1.0	93
Copper	1.08	3.48	1.96	5.46	6.35	1.0	93
Manganese	0.516	1.22	1.24	1.2	1.23	0.5	93
Iron	3.15	6.05	5.19	9.12	6.48	1.0	100
Cadmium	0.47	0.791	0.473	0.953	1.54	0.05	100
TCC, MPN/100 ml	52.25	70.4	89.3	87.7	44	5.0	100

The effects of salinity of drinking water on performance of the animals were conducted at Haramaya University (HU), Ethiopia. A total of 80 animals of two/both species (sheep and goats) and two age groups (growing and mature) purchased from local markets were used for the experiments. The age of growing animals was estimated at 0.6 -1.0 year and mature animals at 1.5-2 years. The experiment lasted for nine weeks and 10 days. When the experiment started, average body weight (BW) of the experimental animals were recorded. The experiment was a completely randomized block design with a 4*2*2 factorial arrangement of treatments, with four water treatments, two animal species, and two age groups. Water treatments were fresh potable tap water of the University (FRW) as a control, and saline waters (SLW) with three levels of salinity (added salt, NaCl). The three levels were low (Low-SLW), moderate (Mod-SLW) and high (High-SLW) with 10, 13.5, and 17 g TDS/l, respectively. Water intake, feed intake, body weight, thermoregulatory traits and blood constituents were measured.

Water and nutrient intakes were greater in mature (Mat) than growing (Gro) Blackhead Ogaden sheep and Somali goats (Table 2). Greater hay dry matter (DM) intake and rectal temperature (RT), and a tendency of greater nutrient intakes, but lower digestion recorded for sheep than goats (Table 3).

Table 2. Variation between age groups in performance and health (paper III).

Age	Water intake (ml/day)	Intake* (g/day)			
		DM	OM	N	NDF
Growing	1226[b]	628[b]	571[b]	17.3[b]	544[b]
Mature	1366[a]	796[a]	723[a]	21.3[a]	689[a]

*OM, N and NDF = organic matter, nitrogen and neutral detergent fiber; a,b,c-means within column without a common superscript letter differ (P< 0.05).

Table 3. Variation between species in performance and health (paper III).

Species	Feed intake (g/day)				Digestion (%)		RT (°C)
	Hay DM	Total DM	OM	NDF	DM	OM	
Somali goat	423[b]	685	138	594	79.6	81.8	37.7[b]
Blackhead Ogaden sheep	470[a]	739	132	640	76	78.5	38.2[a]

a,b,cmeans within column without a common superscript letter differ (P< 0.05).

Water intake and urine increased but digestion decreased in all and blood hematological profiles in Somali goats increased with increasing level of salinity in water. While, water retention and N digestion were greater for mature than growing, and blood hematological profiles were greater for sheep than goats (Table 4).

Table 4. Effects of level of salinity in drinking water on performance and health of Blackhead Ogaden sheep and Somali goat.

Water treatment[1]	Water (ml/day)				Digestion (%)				
	Intake	Urine	Retention		DM	OM	NDF	Nitrogen	
			Growing	Mature				Growing	Mature
FRW	1127[b]	131[c]	656	737	83.6[a]	85.2[a]	83.0[a]	87.5[ab]	89.8[a]
Low-SLW	1281[ab]	278[b]	565[c]	811[a]	72.1[b]	75.1[b]	74.1[c]	78.6	83.6
Mod-SLW	1433[a]	398[a]	793[ab]	723[abc]	74.1[b]	76.8[b]	77.0[bc]	84.9[ab]	79.4[b]
High-SLW	1343[a]	335[ab]	728[abc]	603[bc]	76.9[a]	83.5[a]	82.1[ab]	83.1[b]	90.1[a]

Recommendations

It is highly recommended universities and research institutes to take the role of identifying potential sources of toxic elements from different water sources used for ruminants. Sheep and goats used in this study showed/displayed better salinity tolerance. However, the long-term effect of drinking saline water needs further study using different breeds of sheep and goats with higher levels of salinity.

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POLICY BRIEF - 2-1 | THEME | II
March 2020

The Job Satisfaction of Pharmacy Professionals and Patients' Satisfaction Levels with Pharmacy Service in the Two Public Hospitals in Eastern Ethiopia is low

Yohanes Ayele, Behailu Hawulte, G. Vijai basker, Tilayie Feto and Yadeta Dessie

Key message

- Job satisfaction levels of pharmacy professionals were found to be very low
- The patients' satisfaction levels with pharmacy service were found to be very low.

Introduction

The contemporary healthcare system is required to embrace the concept of quality. Varieties of approach have been used to measure quality in healthcare system. Among these, measuring patients and providers' satisfaction has been advocated as an indicator of the healthcare quality. In this regard, great attention is needed/ required for improving the hospital pharmacy service provision. High patient satisfaction levels could be a useful indicator of effective pharmacists' performances, and added to that satisfied patient is more likely to be compliant to the prescribed medication. At the same time, the level of job satisfaction is one of the predictors of quality of pharmaceutical service. This study assessed the job satisfaction level of pharmacy professionals and patients' satisfaction with pharmacy services.

Approaches and Results

A cross-sectional study was conducted to assess the level of job satisfaction among 248 pharmacy professionals using self-administered semi- structured questionnaire. In addition, face-to-face interviews were conducted with 422 patients to measure their satisfaction with pharmacy service in two public hospitals located in eastern Ethiopia. Data were entered into Epi-Data version 3.1 and exported to STATA version 14.2 for analysis. Associations between the dependent and independent variables were assessed by multiple logistic regression using an Adjusted Odds Ratio (AOR) at 95% confidence interval (CI) and p-value of less than 0.05.

The mean age of pharmacy professionals was 27.6 +4.09. More than half of the respondents (55.45%) had a bachelor degree and 86.36% were working less than 40 hours per week. About one third of them were satisfied with their job, whereas 48.2% were contented with the physical environment (Figure 1). Professionals in the 20-25 age range and bachelor's degree holders were working for more than 40 hours per week, and working/serving in dispensing units were found to have strong associations with job dissatisfaction.
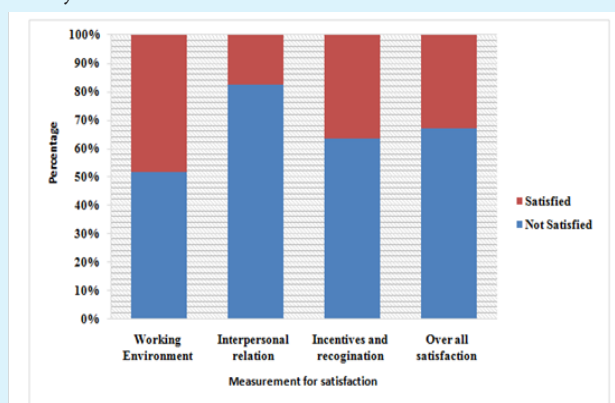

Figure 1: Level of overall job satisfaction and satisfaction with working environment, interpersonal relations and incentive and recognition among Pharmacy professionals in Eastern Ethiopia, 2018 (n=220).

The patient satisfaction results revealed that, the mean age of participants was 35.93+12.56. The overall average satisfaction was 2.29 out of 5.00 (Table 1). Patients within the age range of 26-35 and 36-50 were less satisfied compared with those between 18-25 years. In addition, rural residents, attending secondary education, and collecting all of the prescribed medication from pharmacy were significantly associated with patients' satisfaction.

Table 1: The mean score of client satisfaction towards specific organizational aspects and the overall satisfaction, 2018(n=407)

Variables	Mean	SD	SE	95%CI
Structural aspect of the setting	2.12	0.56	0.03	2.08, 2.19
Medication availability and supply	2.43	1.37	0.68	2.30, 2.56
Pharmacist-patient relationship	2.10	0.63	0.03	2.03, 2.16
Patient counseling	2.51	0.73	0.04	2.43, 2.58
Overall satisfaction	2.29	0.56	0.03	2.24, 2.35

SD: standard deviation; SE: standard error; CI: confidence interval

Recommendations

- The hospital management and other stakeholders should work to ensure appropriateness of workload distribution; strive to meet the unmet needs of professionals, and ascertain the contributing factors in their respective settings.
- Health care providers and administrators should give due attention to factors affecting patients' satisfaction

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POLICY BRIEF - 2-2 | THEME | II

March 2020

Knowledge, Attitude and Practice about Personal Hygiene among 5th - 10th Grade Students in Dire Dawa Administrative Council

Moti Tolera, Andualem Derese, Yadeta Dessie and Dadi Marami

Key message

Proper personal hygiene is influenced by social, familial and individual factors. Age, sex, grade, family income, and learning at private schools were significantly associated with level of knowledge of students' hygienic practice. Age and paternal level of education are also associated with attitude of students whereas; paternal educational status and school location are statistically associated with personal hygiene practice.

Introduction

Proper personal hygiene is influenced by social, familial and individual factors. Poor knowledge, attitude and practice regarding personal hygiene, such as hand washing, tooth brushing, menstrual hygiene. etc. have negative consequences for an individual's long-term health status. This study assessed awareness and practices of personal hygiene and its determinants among 5th-10th grade students of Dire Dawa administration council.

Approach and Results

Cross-sectional study design was employed. Data were generated through questionnaire. Stratified multistage sampling technique was used to select participants. In the first stage, schools were clustered by level (second cycle primary and high school) and then by type as (public and private schools). Accordingly, six government and four private schools were randomly selected. In the second stage, a stratified random sampling with proportional allocation technique was used to select students from each grade level and section. Finally, simple random sampling technique was used to select students from each section. Data were double entered and cleaned using Epi-Data version 3.1, and analysis was made using SPSS version 21.

A total of 818 students were interviewed. From the total participants, 173 (21.1%) of the students' father and one fourth (26.5%) of the students' mothers were uneducated, and 561 (68.6%) of the students' family were categorized as middle-income families. Seven hundred thirty-seven (90%) students drink tap water, 84.2 % of them are urban dwellers, and 78.2% were attending in public schools while. Four hundred eighty-four (58.9%) students had good knowledge

about personal hygiene. Increasing age (AOR 1.457, CI 1.007 – 2.106), female sex (AOR 1.783, CI 1.332 – 2.387), higher grade level (AOR 1.149, CI 1.024 – 1.289), higher family income (AOR 1.665, CI 1.061 – 2.613), being in private school (AOR 2.211, CI 1.455 – 3.360) are significantly associated with good knowledge of personal hygiene Four hundred fifty-one (55.1%) students had good attitude to personal hygiene. Increasing in age (AOR 1.563 CI 1.067 – 2.245) is positively associated whereas father's level of education (AOR 0.879, CI 0.772 – 0.999) is negatively associated with developing positive attitude to personal hygiene. Almost 2 out of 3 (60%) students had good practice on personal hygiene. Father's level of education (AOR 1.187 CI 1.038 – 1.358), living in urban areas (AOR 2.542, CI 1.483 – 4.356), and learning at private school (AOR1.533, CI 1.009 – 2.330) were significantly associated with good practices. Knowledge has positive effect on attitude and practice as 56% of students who had good knowledge also had positive attitude. Similarly, 66.4 % of those who had good knowledge on personal hygiene also have good practices.
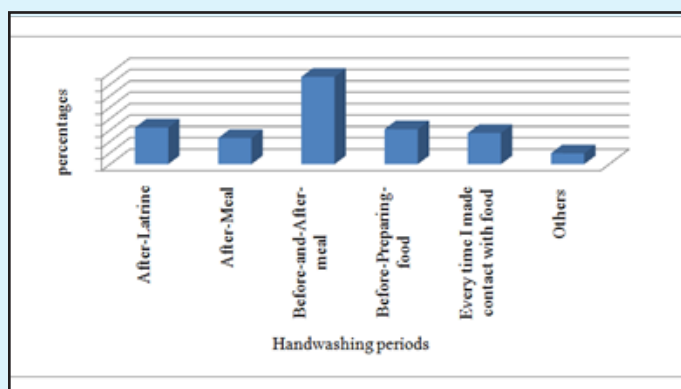

Figure 1: Hand washing practice of students in Dire Dawa administrative council from June 07 – 30, 2015
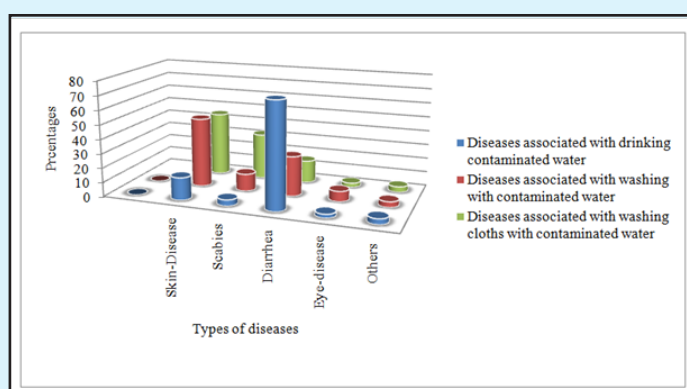
Figure 2: Proportion students' knowledge on some water-associated diseases among grade 5th -10th students of Dire Dawa administrative council from January 07- February 30, 2015.

Recommendations

There is a need for parents and teachers as agents of health promotion to preserve the values of personal hygiene in school children by including personal hygiene in a school curriculum at each cycle.

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POLICY BRIEF - 3-1 | THEME | III
March 2020

Green Synthesized Silver Nanoparticles Using Bacterial and Fungal Reduction Methods Exhibited Antimicrobial Activity against Five Pathogens
U.S. Tandon, Tizazu Habte, Abebaw Adgo and Ameha Kebede

Key message
- Silver nanoparticles (AgNPs) were biosynthesized using aqueous extracellular crude enzymefromAspergillus niger (fungi) and Escherichia coli (bacteria) for the reduction and stabilization of nanoparticles.
- The green synthesized silver nanoparticles exhibited antibacterial activity against gram-positive and gram-negative bacteria with stronger activityagainst gram-positive bacteria.

Introduction
Silver nanoparticles (AgNPs) is/are known to exhibit enhanced antimicrobial activity than its/their corresponding silver ions due toits/their ability to limit cell transduction and cause cell lysis. The antimicrobial potential and reactivity of silver are enhancedsubstantially at nano-dimensions because of larger surface to mass ratio. AgNPs has/have been widely used for food preservation and packaging, as catalytic agents, sensors, therapeutic and bactericidal agents. Previously, attempts have been made to synthesize AgNPs using physical methods such as laser ablation, flame-pyrolysis as well as chemical methods like sol-gel, co-precipitation, hydrothermal and micro-emulsion. However, these synthesismethods are expensive and utilize non-biodegradable reducing agent which might increase environmental toxicity or biologicalhazards.To alleviate this problem, a non-toxic route thatusesbiological systems such as bacteria, fungi, and plant extracts has received great attention and preferable for biological applications. This study reports green synthesis of AgNPs usingtwo microbes and demonstrated their antimicrobial activityagainst gram-positive and gram-negative bacteria.

Approaches and Results
Silver nanoparticles were synthesized using two microbial viz. bacteria and fungi. Escherichia coli (ATCC-25922), Pseudomonas aeruginosa (ATCC-27853), Streptococcus (ATCC-12386), Shigella flexneri (ATCC-12022) Staphylococcus aureus (ATCC-25223), and Aspergillus niger were obtained from Ethiopian Public Health Institute, Addis Ababa, Ethiopia. The cell-free supernatants from A. niger and E. coliextracts were used as sources of enzyme for the reduction and stabilization of silver nanoparticles, whereasthe antibacterial activity testwas carried out using disc diffusion method on five pathogens.Three of them were gram negative bacteria (E. coli, P. aeruginosa and S.flexneri) and the other two were gram positive bacteria (Streptococcus spp. and S. aureus). The synthesis of silver nanoparticles was confirmed by visual observation through color change from yellow to orange for E. coli and from light brown to dark brown for A. niger. The synthesized AgNPs were characterized by UV-Vis Spectrometry and Fourier Transform Infrared Spectrometry.

The UV-Vis absorption maxima ofAgNPs synthesized by E. coliand A. nigerappeared at 416 nm and 425 nm, respectively, confirming reduction of silver ion to AgNPs. Extracellular crude extracts obtained from both microbes did not show any antibacterial effect on the tested pathogens. However, AgNPs synthesized by both species exhibited antibacterial effect. The major mechanism for antibacterial properties of silver nanoparticles was through anchoring to and penetration in the bacterial cell wall. Once nanoparticles are inside the cell, they modulate the cellular signaling by dephosphorylating the putative key peptide. The AgNPsshowed stronger antibacterial activities on gram positive bacteria than on gram negative bacteria (Table 1). The results also indicated that a larger inhibition zone was produced for the AgNPs synthesized at the lowest concentration (1 mM) AgNO3 precursor.

Table 1. Comparison of antibacterial activities of synthesized AgNPs on five pathogens

S.N	Test Pathogens bacteria	Triplicated Antimicrobial Activities test Average Zone of Inhibition in (mm)						
		E_1	E_2	A_1	A_2	E_0	A_0	Antibiotic
1.	E. coli(ATCC-25922)	11.00	12.50	11.50	12.50	0.00	0.00	21.00mm
2.	P. aeruginosa(ATCC-27853)	10.50	11.00	10.00	11.50	0.00	0.00	20.00mm
3.	S.flexneri(ATCC-12022)	11.75	12.17	11.83	14.00	0.00	0.00	19.00mm
4.	Strep(ATCC-12386)	12.50	14.00	11.00	12.00	0.00	0.00	26.00mm
5.	Staphylococcus aureus (ATCC-25223)	13.33	14.75	14.00	17.00	0.00	0.00	29.00mm

E1- 10 mM AgNO3 + supernatant fromE. coli; E0 – supernatant from E. coli; E2- 1 mM AgNO3 + supernatant fromE.coli; A0 – supernatant from A. niger; A1- 10 mM AgNO3 + supernatant from A.niger; Antibiotic-Chloramphenicol; A2- 1 mMAgNO3 + supernatant from A.niger

Policy Recommendations

- Microbial based reduction method is cost-effective and environmentally friendly for synthesis of silver nanoparticles.
- Biosynthesized silver nanoparticlesshould be promoted for further applications in different industries

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POLICY BRIEF - 3-2 | THEME | III
March 2020

Locally Available Agricultural Wastes Exhibited High Removal Efficiency for Heavy Metals-from Waste water

Minbale Aschale, Fikadu Tsegaye, Meseret Amde and Awugchew Teshome

Key message

•   Abundantly available low-cost agricultural wastes viz. coffeehusks, potato peels, banana peels and onion skin powder were effective biosorbent for Pb, Cd, Cu, Cr, Zn and Ni removal from wastewater.

•   The as-prepared biosorbents showed high adsorption capacity and reusability for remediation of studied heavy metals.

Introduction

Heavy metals such as Lead (Pb), Chromium (Cr), Cadmium (Cd), and Arsenic (As) remediation from wastewater is of special concern due to their toxicity and non-biodegradable nature. There are several technologies for heavy metals removal from wastewater such as membrane filtration, reverse osmosis, ion exchange, aerobic and anaerobic biological treatment. However, these methods are difficult to implement in developing country due to their high cost, the need for skilled manpower for system operation and maintenance, and the challenges of ensuring a continuous supply chain for the required chemicals and materials. In this regard, adsorption could be a good alternative technology even at low concentrations because it provides flexibility in design, and high-quality treated effluent. Besides, it is inexpensive, reversible, and can be regenerated.

Agricultural wastes are abundant and locally available natural materials which are potential sources of low-cost adsorbents. Moreover, the application of agricultural wastes as adsorbent offers highly effective technological means to mitigate global warming, solve the disposal problems and save the high preparation cost of adsorbents. Hence, the aim of this study was to evaluate the effectiveness andsustainability of locally abundant low-cost agricultural wastes for Pb, Cu, Ni, Zn, Cd and Co removal from wastewater.

Approaches and results

Composite samples of potato peels, coffee husks, banana peels and onion skins were collected from Harar City, Bate, and Haramaya University student cafeteria. The dried samples of agricultural wastes were crushed and grinded into powderand screened to four different particle sizes (<250 µm, 0.25 mm, 0.300 mm and 0.75 mm). The removal effi-

ciency of prepared agricultural wastes powder was studied in a batch adsorption system by varying the effects of contact time, particle size, the dosage of adsorbent, initial concentrations, pH and solution temperature. The preparation of low-cost adsorbents from agricultural wastes is shown in Figure 1.

Figure 1: The preparation procedure for low=cost adsorbents from agricultural wastes

The amount of Cu, Ni, Zn, Cr, Cd and Pb adsorption by the agricultural wastes were dependent on the metal types, the concentration of the metals and the type of agricultural by products.The results revealed that the heavy metals removal using as-prepared biosorbent increased with increasing the contact time, decreasing the particle size, increasing the adsorbent dosage and decreasing initial metal concentrations.

Figure 1: The preparation procedure for low=cost adsorbents from agricultural wastes

Policy Recommendations

• Water and sewerage authorities should give due attention to biological means of heavy metals removal from wastewater.

• The utilization of agricultural wastes as effective adsorbents for the remediation of polluted water could generate environmental and economic benefits.

Haramaya University Research Themes and Sub-themes

Theme 1: Productivity and Environmental Sustainability for Food Security and Poverty Alleviation
Sub-themes:
1. Animal Production and Health
2. Plant Production and Health
3. Environment, Natural Resources, and Climate Change

Theme 2: Human Health, Nutrition, and Welfare
Sub-themes:
1. Health Promotion and Disease Prevention
2. Advances in Curative and Rehabilitative Health Services and Disease Management
3. Nutrition, Food Safety and Security, Dietetics, and Nutritional Problems
4. Reproductive Health, Maternal and Child Health

Theme 3: Energy, Engineering, and Information Technologies
Sub-themes:
1. Information Technology and Computing
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3. Energy Resource Development and Utilisation
4. Postharvest Technology, Processing, and Food Analysis
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Theme 4: Human and Social Development
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1. Society, Culture, and Tourism
2. Educational Advancement and Quality Assurance
3. Population, Gender, and Development
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Theme 5: Institution, Innovations Systems and Economic Development
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1. Economic Development, Policy, and Institutional Analysis
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Theme 6: Basic Science Research
Sub-themes:
1. Bioscience Research
2. Chemical Science Research
3. Biophysics and computational physics
4. Mathematical Research

POLICY BRIEF -4-1 | THEME | IV
March 2020

Post Graduate Diploma Graduates have better Teaching Performance in Eastand West Hararghe Secondary Schools

Anwar Ahmed, Yordanos Tekle and Melkamu Alemu

Key message

Post Graduate diploma program has a positive contribution in enhancing teachers' performance and producing quality teachers for secondary schools. Through training, the program has equipped secondary school teachers with diverse active learning techniques and strategies as well as multiple mechanisms of applying student assessment techniques. For a better performance and implementation of the program-concerted effort is demanded by all concerned bodies

Introduction

The quality of education primarily depends on the quality of teachers available in an education system. The quality of human resources in the form of teachers, often dictates the extent of the effectiveness of educational programs. Secondary school teachers in Ethiopia are obliged to pass through different training programs. For instance, prior to 2010, teachers were given training for four consecutive years in which applied, pedagogy, and practicum courses were offered simultaneously. Starting from 2011, Post Graduate Diploma in Teaching (PGDT), which was a new system of secondary teacher education, came into effect. Consequently, the four years pre-service secondary school teacher education was reshaped to three years training period to qualify candidates for applied degree, and later on after their graduation, teacher trainees are required to attend pedagogical and practicum training for one year before they go to secondary schools for the actual teaching. This study investigatedTeaching Effectiveness of Postgraduate Diploma Program Graduates in the case of east andwest Hararghe.

Approaches and Results

Survey research design that incorporated both quantitative and qualitative data types was employed. The participants of the study comprised 261 teachers selected by stratified random sampling, and 21 principals and all supervisors were selected using purposive sampling techniques. Data were collected through questionnaire, key informant inter-view and document analysis. Correlation was employed to see the association between experience of PGDT graduates and their level of utilizing different active learning methods and continuous assessment techniques. The t-test was used to test whether male and female PGDT graduates were different in using active learning methods (ALMs) and continuous assessment (CA) techniques. The results indicated that: lecturing, group discussion, brainstorming and questioning and answering techniques were the most frequently used methods of teaching by PGDT graduates while individual studies, group works, paper pencil tests, home works, classroom participations, and final exams were the most frequently utilized methods of continuous assessment by PGDT graduates of the study areas. The correlation result indicated the association between teaching experience and utilization of continuous assessment strategies was not significant. Moreover, the relationship of academic level and teaching experience of the PGDT graduates with the application of various active learning approaches for classroom instruction was not significant.

Based on the t-test result, there was no significant mean difference between male and female PGDT graduates in utilizing various active learning approaches in their classroom instruction. Similarly, there was no significant difference between male and female PGDT graduates in applying continuous assessment to assess their students learning.

Policy Recommendations

• Commitment of the teachers to improve their students learning, the community and the society in general is vital. It is also important to provide further short-term training opportunities to improve PGDT graduates' understanding and skill of utilizing various active learning approaches.

• Strict follow up should be taken upon teachers and encourage them to use less frequently utilized assessment techniques to improve the implementation of continuous assessment. abroad with foreign currency.

VISION

Haramaya University aspires to become one of the best research universities in Africa by the year 2025.

MISSION

Undertaking demand-driven, problem-solving, and cutting-edge research, and disseminating generated and adapted knowledge and technologies for socio-economic transformation of the society.

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POLICY BRIEF - 5-1 | THEME | V
March 2020

Improved Agricultural Technology Dissemination by Haramaya University Enhanced Farm Income, Food Security and Dietary Diversity in Eastern Ethiopia

Chanyalew S. Aweke, Muluken G. Wordofa, Getachew S. Endris, Dereje K. Moges, Jemal Y. Hassen and Debbebe T. Rorisa

Key Message

•Improved agricultural technologies play vital role in rural household economies. Households adopting improved agricultural technologies have higher farm income, food security status, and dietary diversity.

Introduction

Smallholder farmers generally have limited access to improved agricultural technologies, modern agricultural extension and advisory services, and face huge barriers to input-output market integration. Available technologies also hardly meet the specific farming and livelihood needs and priorities of smallholder farmers. To this end, there is an urgent call for increased investment in research, development and extension activities that are geared towards improving production, productivity, food security and overall wellbeing of smallholder farmers. Agricultural universities and research centers have a very important role to play other than teaching and research. They are agents for developing relevant technologies, providing community extension services, and facilitating technology dissemination and adoption. However, there are limited evaluation studies in Ethiopia on the impact and performance of technologies produced, disseminated and/or scaled-up by agricultural universities and their roles in improving welfare. The current study was conducted to systematically evaluate the impact of agricultural technologies disseminated by Haramaya University on household income, food security and dietary diversity in eastern Ethiopia.

Approaches and Results

This research employed a mixed research design. Quantitative data were gathered using survey questionnaires from a total of 248 randomly sampled households – recategorized as users (119) and non-users (129) of technologies disseminated by Haramaya University. Qualitative data were also generated using 10 Focused Group Discussions (FGDs), 14 Key Informant Interviews (KIIs), and observations. The qualitative data focused on perception about technologies released by the University, process of technology dissemination and adoption, targeting criteria for technology dissemination, and major challenges in the process of technology adoption. Observational data were gathered by observing various livelihood activities, farming practices, activities of

Table 1. One-to-One Nearest Neighbour Matching Results of Average Treatment Effect on the Treated (ATT)

Outcome Indicator	Sample	(1) Treated	(2) Control	(3) Difference	(4) Std. Err.	(5) T-stat	(6) Bootstrap Std. Err. [a]	(7) z
Farm Income[b]								
	Unmatched	33082.35	14923.26	18159.09	10456.27	1.74		
	ATT	33508.46	10477.18	23031.28	11393.29	2.02	11626.10	1.98 **
Food Consumption Score (FCS)[b]								
	Unmatched	62.21	56.06	6.14	3.35	1.83		
	ATT	62.01	48.48	13.53	4.50	3.01	6.25	2.16 **
Household Dietary Diversity Score (HDDS)[b]								
	Unmatched	7.56	6.67	0.89	0.32	2.78		
	ATT	7.52	6.30	1.22	0.44	2.79	0.37	3.27 ***

Note: ATT = Average Treatment Effect on the Treated; Std. Err = Standard Error
*, **, *** denote statistical significance at 10%, 5%, and 1% level, respectively
a Bootstrap Standard Errors (Std. Err.) on the difference (with 50 replications)
b 129 (all) untreated and 117 (out of 119) treated households found on the common support region were used.

Farmers' Training Centers (FTCs), and natural resource management efforts of local community. Quantitative data were analyzed using descriptive statistics and Propensity Score Matching (PSM) procedure whereas qualitative data were summarized, narrated and interpreted through content analysis.

The key findings of the study revealed that households who adopted improved agricultural technologies have/have had higher household income, food security status as measured by Food Consumption Score (FCS), and dietary diversity compared to the non-users as indicated in Table 1.

More specifically, the studyfound that households who adopted improved agricultural technologies have earned, on average, 23031.28 birr/year; a 13.53 higher FCS; and, a 1.22 higher dietary diversity score compared to the non-users of such agricultural technologies.

The qualitative analysis also showed that technologies released by the university generally have gained widespread acceptance and demanded by smallholder farmers. Farmers have also positive impressions about the technologies promoted by the university and their contributions towards enhancing household food security and income. In relation to farmers' technology selection criteria, the findings have showed that amount of yield and marketability potentials are the most important traits to adopt technologies. However, several factors have been identified as constraints in thedissemination and adoption of agricultural technologies. These include low adaptability to agro-ecological conditions, irregularities in input delivery, susceptibility to pests and diseases, lack of regular follow-up and feedback mechanism, technology aging, high turnover of Development Agents (DAs), and limited knowledge and skills in the application of the technologies.

Recommendations
The University should:
• promote inclusive and gender sensitive, market-oriented and demand-driven technologies through increased university-community linkages and multi-stakeholder engagements
• promote participatory technology generation and dissemination that focuses on a value-chain approach

• provide tailor-made training and capacity building activities for Das/DAs/Development Agents as well as strengthen FTCs and rural agripreneurship initiatives to enhance income and employment

Other stakeholders, such as policymakers at local, regional, and national levels should:
• support efforts to promote research and outreach activities in universities
• strengthen FTCs/Farmers' Training Centers and work on reducing Das/DAs/Development Agents turnover through adequate incentive packages
• promote access to credit and saving facilities to enhance technology adoption
•work closely with the university in problem definition, research and dissemination of results

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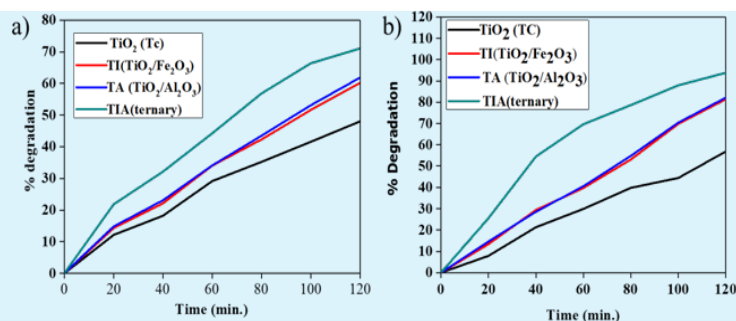4. Mathematical Research

POLICY BRIEF -6-1 | THEME | VI
March 2020

High Concetration of Pesticides Residue Detected in Water and Khat (*Catha edulis*) Leaves in Eastern Ethiopa
Dagne Bayih, Tesfaye Muluye, Teshome Gonfa, Temesgen Achamo and Tamado Tana

Key Message
• The level of pesticides in water and Khat (*Catha edulis*) leaves collected from Haramaya and Adele area was determined. The concentration of Diazinon, Adrin, Dialdrin, DDE and α-BHC were higher in water samples than in khat leaves while the concentration of Heptachlor and DDT were higher in khat leaves.
• The photocatalytic degradation of DDT was conducted using ternary mixed oxides (TiO2/Fe2O3/Al2O3) which was found to be effective photocatalyst for degradation of DDT.

Introduction
The use of pesticides in modern agriculture has significantly increased productivity. Agricutural pesticides are widely used to manage pests to improve agricultural production. However, excessive use of pesticides is harmful to environment through contamination of soil, surface and underground water resources. They cause chronic health effects, including cancer, neurological effects, respiratory diseases, and genetic disorders if they are exposed to humans for long period of time. Among different pesticide groups, chlorinated organic pesticides are persistent in both fresh and salt water and hence, they are resistant to degradation.

Therefore, this study was conducted to determine the level of pesticide residue in water and Khat (*Catha edulis*) leaves; and photo-catalytic degradation of Dichloro-diphenyl-tri-chloroethane (DDT) in water samples collected from Adele lake and Haramaya district, east Hararge Zone, Ethiopia.

Approach and Results
Water and khat samples were collected from Adele Lake and Haramaya district, respectively. The samples were extracted using liquid-liquid extraction techniques and concentration of pesticides were determined using GC-coupled with ECD. Moreover, the photodegradation of DDT in water samples were conducted using synthesized TiO2/Fe2O3/Al2O3 nanoparticles (NPs) and determined using UV-Vis spectrometry.

Alpha-BHC, Diazinon, DDT and 4,4-DDE were detected in all water samples. The highest concentration of pesticide obtained in water sample is Diazinon and the lowest concentration is Dialdrin. But in the case of khat leaves, DDT and Aldrin are the highest and lowest concentration, respectively. Dialdrin and 4,4-DDE are not detected in khat leaves (Table 1).

Except heptachlor, the concentrations of all pesticides in water sample were higher than that of khat leaves while high level of DDT was recorded in the khat samples. This suggests that DDT is currently in use in the study area.

Table 1: The Total Concentration of Pesticides in Water and Khat Samples.

Sample	Pesticides and their concentration (mg/kg)						
	α-BHC	Diazinon	Aldrin	Heptachlor	Dialdrin	4,4-DDE	DDT
Water	$0.0270 \pm 1.3 \times 10^{-2}$	$0.0420 \pm 1.9 \times 10^{-2}$	$0.0211 \pm 1.1 \times 10^{-2}$	$0.0027 \pm 1.9 \times 10^{-3}$	$0.001 \pm 1.2 \times 10^{-3}$	$0.0238 \pm 5 \times 10^{-3}$	$0.0049 \pm 2.9 \times 10^{-3}$
Khat	$0.00104 \pm 6 \times 10^{-4}$	$0.00180 \pm 1.5 \times 10^{-3}$	$0.00025 \pm 6.1 \times 10^{-5}$	$0.00067 \pm 2.54 \times 10^{-4}$	ND	ND	$0.00360 \pm 2.9 \times 10^{-3}$

Table 1: The Total Concentration of Pesticides in Water and Khat Samples.
ND = non detected

Figure 2. Plots of percentage degradation of DDT as function of time using different photocatalyst(a) under UV irradiation (b)under visible irradiation.
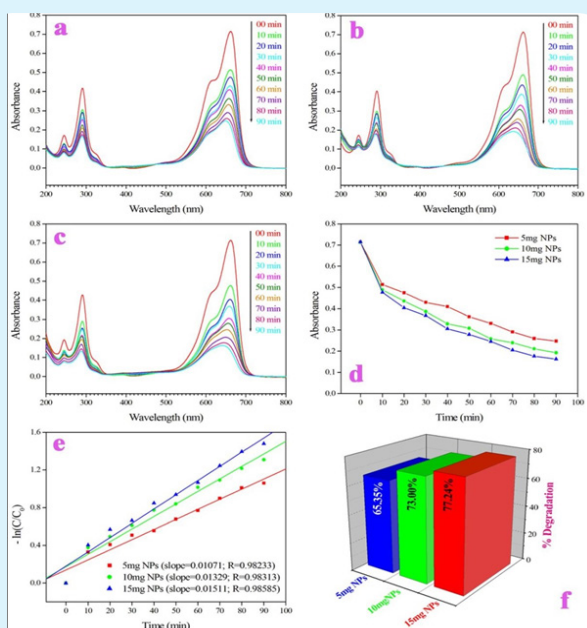

Figure 3.UV–Vis spectra of DDT as a function of time in the presence of TiO2/Fe2O3/Al2O3 (a) 5mg photocatalyst (b) 10mg photocatalyst (c) 15mg photocatalyst (d) plot of absorbance versus time (e) plot of -ln(C/C0) versus time and (f) % degradation.

The extent of DDT degradation was found to be very high under visible radiation for the same doze of the photocatalysts and time. TiO2/Fe2O3/Al2O3(TIA), and ternary mixed oxide showed higher photocatalytic efficiency than all the rest under the same irradiation time. TiO2/Fe2O3 (TI) and TiO2 /Al2O3(TA) showed almost similar efficiency for the degradation under UV as well as visible radiation (Figure 2).

TiO2 commercial (Tc) showed the lowest efficiency compared to the rest, which indicates mixed oxides possess good degradation efficiency for DDT under both UV and visible radiation. The pesticide degradation increases with an increasing catalyst dosage, which is characteristic of heterogeneous photocatalysis (Figure 3). The increase in catalyst amount actually increases the number of active sites on the photocatalyst surface thus leading to an increase in the number of hydroxyl radicals(•OH) which are responsible for the actual degradation of pesticide solution

Recommendations

• Since high concentrations of pesticides were detected in water and khat leaves, which are above the recommended limit given by WHO, concerned stakeholders such as MoA, MoH, etc should pay attention.
• Pesticides have been used excessively in the study areas and hence, awareness creation about adverse health and environmental effects is highly required.

POLICY BRIEF -6-2 | THEME | VI
March 2020

Human Blood Group Type has Association with Malaria (*Plasmodium Falciparum*) Infection
Tamiru Oljira, Temesgen Tola, Olana Kumessa and Gudina Egeta

Key Message
• The present study confirmed that cases with blood type A were more susceptible while individuals with blood type O are less susceptible to Plasmodium falciparum malaria.

Introduction
The studies of the relationship between parasitic diseases and human genetic variation have started right after the discovery of the genetic markers around the first decade in the 20th century. The ABO blood group system (OMIM 110300) polymorphism was the first genetic polymorphism discovered in human population in 1900 and it is one of the classical molecular markers. It has been studied in relation to many human characteristics as well as disease susceptibility; including susceptibility to infectious diseases such as malaria, a parasitic disease caused by four protozoan parasites belonging to the genus Plasmodium: P.vivax, P.falciparum, P.ovale, and P. malariae.

Among the four P. falciparum is the most devastating in its cause of morbidity and mortality. In Sub-Saharan Africa it is mainly transmitted to humans with a bite from a mosquito vector species known as Anophelesgambiae. The association of the ABO blood group system and malaria has not been well studied in the context of Ethiopia in general and in Miesso district in particular, which is malaria endemic area.

Approach and Results
A case-control study design was used to evaluate the association between malaria, particularly P. falciparum and P. vivax malaria, with the distribution of the blood groups (A, B, AB, and O in ABO and Rh+ and Rh- in Rh-factor) during malaria peak seasons. The cases were selected from two health centers in the district: Miesso and Asebot Health Centers while the controls were selected from healthy people in the towns and schools in the towns. The controls were selected in such a way that matching was done with the cases in terms of ethnicity, age distribution, sex distribution and residence. In total, 168 individuals (56 malaria cases and 112 controls) were involved in the study. For all blood types for ABO and Rh group systems were determined. For the case group, malaria type and severity levels were also assessed. Association test was done with chi-square test between blood group and malaria status as well as with severity levels.

The study revealed that cases with blood type A were more susceptible to severe malaria as compared to patients with other blood types while blood type O was less susceptible to malaria. The current finding shows there is significant association between ABO blood group of case and control, and no association between malaria infection and Rh blood group system (Table 1-3).

Table 1. Sex, age and ethnic group distributions of participants in case, control and total

Variable		Number (Percentage)			
		Case (Column %)	Control (Column %)	Total in a variable (Column %)	χ2,DF,P
Sex	Female	23 (41.1)	66 (58.9)	89 (52.98)	
	Male	33 (58.9)	46 (41.1)	79 (47.02)	
	Total	*56*	*112*	*168*	*4.78, 1, 0.029*
Age Class	0-10	10 (17.86)	4 (3.57)	14 (8.33)	
	11-20	31 (55.36)	32 (28.57)	63 (37.50)	
	21-30	13 (23.21)	49 (43.75)	62 (36.90)	
	>=31	2 (3.57)	27 (24.11)	29 (17.26)	
	Total	*56*	*112*	*168*	*29.85,3, <0.001*
Ethnicity	Oromo	49 (87.5)	90 (80.4)	139 (82.74)	
	Amhara	3 (5.4)	12 (10.7)	15 (8.93)	
	Somali	4 (7.1)	10 (8.9)	14 (8.33)	
	Total	*56*	*112*	*168*	*1.57, 2, 0.455*

Table 1. Sex, age and ethnic group distributions of participants in case, control and total

Table 2. Frequency distribution of ABO and Rh blood group phenotypes sex, age and ethnicity

Variable		ABO Blood Type					Rh-Factor		
		A	B	O	AB	Total	Negative	Positive	Total
Sex	Female	16	18	47	8	89	6	83	89
	Male	24	12	37	6	79	5	74	79
	χ2, DF, P	3.69, 3, 0.296					0.012,1, 0.914		
Age Class	0-10	6	1	5	2	14	1	13	14
	11-20	20	15	23	5	63	5	58	63
	21-30	10	11	35	5	61	4	57	61
	>=31	4	3	21	2	30	1	29	30
	χ2, DF, P	16.42,9, 0.059					0.713,3, 0.870		
Ethnicity	Oromo	33	28	71	7	139	10	129	139
	Amhara	5	2	5	3	15	1	14	15
	Somali	2	0	8	4	14	0	14	14
	χ2, DF, P	16.34,6, 0.012					1.076,2, 0.584		
Total		40	30	84	14	168	11	157	168

Table 3. ABO blood group of the respondent and malaria severity level

	Severity level	A	B	O	AB	Total
Case	Severe	18(32.1%)	7(12.5%)	4(7.14%)	4(7.14%)	33(58.9%)
	Mild	3(5.4%)	5(8.9%)	14(25%)	1(1.8%)	23(41.1%)
	Total Cases	21(37.5%)	12(21.4%)	5(32.14%)	5(8.94%)	56(100%)
Control		19(17%)	18(16.1%)	66(58.9%)	9(8%)	112(100.00%)

Policy Recommendations

The level of awareness about this susceptibility differences in Ethiopia is very low. This information may be helpful for people in taking the precautionary steps before traveling to areas where falciparum malaria is endemic.

Ministry of Health policy makers can also use this information in planning the control of malaria in the long run of decreasing morbidity and mortality rates.