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Lychee Industry in Vietnam

Capacity of Moroccan Olive Kernel

Highlights

Description of Sheep Production

Dairy Products Consumption Profile

Discovering Thoughts, Inventing Future

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Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue

1. Determination and Effects of Milk and Dairy Products Consumption Profile in Thrace Region to some Microbiological Parameters. *1-8*
2. Electrochemical Evaluation of the Antioxidant Capacity of Moroccan Olive Kernel. *9-13*
3. Determinant Competitiveness of Lychee Industry in Vietnam. *15-24*
4. Changing Some of Composition and Properties Podzolic Soils of an Average Taiga of West Siberia when Introduced Eastern Galega (Galega Orientalis Lam.). *25-32*
5. Nutritional Values of Smoked *Clarias Gariepinus* from Major Markets in Southwest, Nigeria. *33-42*
6. Description of Sheep Production System, Husbandry Practices and Assessment of Major Constraint in Dawuro Zone and Konta Special Wereda of South Region of Ethiopia. *43-60*

v. Fellows and Auxiliary Memberships
vi. Process of Submission of Research Paper
vii. Preferred Author Guidelines
viii. Index

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Determination and Effects of Milk and Dairy Products Consumption Profile in Thrace Region to some Microbiological Parameters

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Istanbul University, Turkey

Abstract- Milk and its products are very important for development and physiology of human organism. In developed countries annual consumption of milk per person is above 100 liters while this rate in our country is about 25 liters. Unfortunately milk is not consumed as needed especially by children. According to the Index of the Global Diary, economic development, urbanization and increasement of the purchasing power of middle class citizens are the most important factors of the epanding dairy market. Annual consumption milk and its products per person is expected to increase all over the world expect West Europe between the years 2010 - 2020, and this expection is commented as the increasement of purchasement is being slide from west to east. In spite of milk and its products are important nutrition elements for humans, they can be very serious risk factors for consumer health if they are produced under unsufficient hygiene conditions and / or absence of food security systems.

Keywords: *milk, dairy products, microbiology, hygiene, correlation.*

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Determination and Effects of Milk and Dairy Products Consumption Profile in Thrace Region to some Microbiological Parameters

Emek Dumen [α], Funda Hatice Sezgin [σ], Harun Cerit [ρ] & Gülay Merve Bayrakal [ω]

Summary- Milk and its products are very important for development and physiology of human organism. In developed countries annual consumption of milk per person is above 100 liters while this rate in our country is about 25 liters. Unfortunately milk is not consumed as needed especially by children. According to the Index of the Global Diary, economic development, urbanization and increasement of the purchasing power of middle class citizens are the most important factors of the epanding dairy market. Annual consumption milk and its products per person is expected to increase all over the world expect West Europe between the years 2010 -2020, and this expection is commented as the increasement of purchasement is being slide from west to east. In spite of milk and its products are important nutrition elements for humans, they can be very serious risk factors for consumer health if they are produced under unsufficient hygiene conditions and / or absence of food security systems. The aim of this study was to determine the consumption profile of the public who live in Thrace region and how the preferences of the public affect the microbiological quality of the milk and its products consumed by the public. The aim of this study was to determine the consumption profile of the public who live in Thrace region and to expose how the preferences of the public affect the microbiological quality of the milk and dairy products consumed by the public. For this purpose, 450 houses in 3 main cities of Thrace region were visited (Edirne, Kırklareli and Tekirdağ / 150 houses for each city) without prior notice and 9 questions about consuming profiles (which are considered to be effective to the microbiological quality of milk and dairy products that the families consumed) were asked to the household. Besides 1 dairy sample was collected from each house and the samples were analyzed for TAB (total aerobic bacteria), coliforms, *Escherichia coli, Listeria monocytogenes, Staphlococcus aureus, Salmonella* spp. and *Bacillus cereus.* According to the results, it was determined that, consumption profile of the dairy products of the public was directly related with microbiological risk factors.

Keywords: milk, dairy products, microbiology, hygiene, correlation.

Özet- Süt ve ürünleri insan organizmasının gelişimi ve fizyolojisi açısından son derece önemli gıda maddeleridir. Gelişmiş ülkelerde 100 litreye ulaşan ve hatta üzerine çıkan yıllık kişi başı süt tüketimi Türkiye'de 25 litreyi geçmemektedir. Türkiye'de çocuklar başta olmak üzere süt tüketiminin çok azdır. Küresel Süt Endeksi'ne göre süt ve ürünlerinin tüketimindeki yüksek artışın en önemli itici güçleri arasında; ekonomik büyüme, kentleşme ve orta sınıfın artan satın alma gücü yer almaktadır. 2010-2020 yılları arasında süt ürünlerine olan talebin, kişi başına süt tüketiminde birinci sırada olan Batı Avrupa hariç, dünyanın her yerinde artması beklenmekte, süt ve ürünlerinin tüketimindeki yüksek artış ekonomik gücün Batı'dan Doğu'ya kaydığının bir göstergesi olarak görülmektedir. Ancak süt ve ürünleri, içerdikleri optimuma yakın besin unsurları sayesinde ideal bir besin maddesi olmasının yanısıra, üretimden tüketim sürecine kadar doğru gıda güvenlik sistemlerinin uygulanmaması halinde tüketici sağlığı açısından ciddi bir risk faktörü haline gelebilmektedirler. Bu çalışmada Trakya bölgesindeki 3 ana ilde (Edirne, Tekirdağ ve Kırklareli olmak üzere) yaşayan halkın süt ve ürünlerinin tüketim profillerinin belirlenmesi, tüketim alışkanlıklarının ve tercihlerinin süt ve ürünlerinin mikrobiyolojik kalitesini nasıl etkilediğinin ortaya konulması ve tüketici sağlığı açısından olası risk faktörlerinin araştırılması hedeflenmiştir. Vc-Bu amaçla, her bir ilden 150 hane önceden haber verilmeksizin ziyaret edilmiştir. Hane halkına süt ve ürünlerinin satın alım sürecinden mikrobiyolojik kalitesi üzerine etkili olduğu düşünülen ve tüketicilerin tercih profillerini de kapsayan 9 adet soru sorulmuştur. Yanısıra, her bir evden 1 adet süt / süt ürünü örneği alınarak her bir örnek *Escherichia coli, Listeria monocytogenes, Staphlococcus aureus, Salmonella* spp. ve *Bacillus cereus.* Açısından analiz edilmiştir. Elde sonuçlar, süt ve ürünlerinin satın alımdan tüketime kadar geçen süreçte tüketiciye bağlı değişkenlerin süt ve ürünlerinin mikrobiyolojik kalitesi üzerine birinci derecen etkili olduğunu göstermiştir.

Anahtar sözcükler: süt, süt ürünleri, mikrobiyoloji, hijyen, korelasyon.

I. Introduction

Milk is a very important human nutrient because of its optimal components. However, milk and its products are very appropriate media for both saphrophytes and pathogens due to same reason. Milk and dairy products may have serious microbiological risk factors for consumers unless they are produced, stored, transported and sold under inadequate hygienic conditions. According to the laws related to the new hygiene regulations of European Union (EU), it is a compulsory process for all kinds of food plants to apply food security systems at the all steps of the production and selling practices since 2005 (5). Foodborne pathogens are important risk factors for public health all

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over the world because of their widespread existence features (9), and even milk and milk products are produced under best hygienic applications, they may risk public health because of secondary contamination sources as consumers' hands, house storing conditions, false usages and the equipments used in houses.

In developed countries, one of the most important preventive factors for the public health is to provide healthy and qualified foods for balanced diets to the consumers while eliminating the possible pathogens and producing all kinds of foods under sufficient hygienic conditions. Continuously increasing population of the world, pollution of the natural sources, industry, lack of education due to economic reasons complicates to provide hygienic and safe food products and enlarges nutrition problems and cause to increase the cases suffering from food-borne illnesses and toxications all over the world. Based on these reasons, it is very important to determine the contamination ways of the foodborne pathogens, and the risk factors.

In this study, it was aimed to determine the effects of milk and dairy products consuming profiles (brand choice, obtaining the milk and milk products packaged / open, house storing conditions after purchasing, dairy products choice etc.) to the microbiological quality of dairy products in 3 main cities of Thrace region (Edirne, Tekirdağ and Kırklareli) by using statistical methods. It was also aimed to expose the correlations and effective factors that influence public health due to consuming habits.

II. Material and Methods

a) House Visits and Questionnaire Program

Total 450 houses in three main cities of Thrace region were visited (150 houses for each city) without prior notice and 9 questions about consuming profiles (which are considered to be effective to the microbiological quality of milk and dairy products that the families consumed) were asked to the household. The questions that are asked are indicated below:

- Which dairy products do you consume generally?
- How many times do you food shopping in a week, what is your dairy products purchasing frequency?
- What kind of sales point (supermarket, grocery, local markets, etc.) do you prefer for milk and dairy products?
- Do you purchase milk and dairy products packaged and / or unpackaged – open? Which one / ones are packaged / unpackaged – open?
- What is average consuming period of milk and dairy products after purchasing?
- How do you store the milk and dairy products that you have purchased?
- Do you prefer a sales point specially for purchasing milk and dairy products ? If the answer is yes, why?
- Do you observe that the dairy products that you purchased spoiled and / or spoiling up to consuming period?
- Do you consider the expiry date of the milk and dairy products that you have purchased?

b) Sampling Program

During the study, 450 samples were collected. The collected samples were analyzed for TAB, coliforms, *E. coli, S. aureus, Salmonella* spp., *L. monocytogenes* and *B. cereus*. Table 1 shows the details of the collected samples. Table 1

Table 1: Details of the collected samples

City	Type of dairy product	Number of collected samples
Tekirdağ	Cheese	40
	Yogurt	30
	Milk	30
	Butter	20
	Ice cream	20
	Cream	10
Edirne	Cheese	40
	Yogurt	30
	Milk	30
	Butter	20
	Ice cream	20
	Cream	10
Kırklareli	Cheese	40
	Yogurt	30

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Milk	30
Butter	20
Ice cream	20
Cream	10
TOTAL	450

c) *Microbiological Analyses*

TAB (total aerobic bacteria), coliforms, *E. coli (Escherichia coli), S. aureus (Staphylococcus aureus), L. monocytogenes (Listeria monocytogenes). Salmonella* spp. and *B. cereus (Bacillus cereus)* and were determined for each milk sample. Microbiological analyses were performed according to FDA / BAM (2005).

TAB: TAB was enumerated in PCA (Plate Count Agar) after incubation at 30 °C for 48 h.

Coliforms: Coliforms were isolated by surface plating on VRBA (violet red bile agar). Plates were incubated at 37 °C for 24 h.

E. coli: E. coli were examined by surface plating on TBX (Tryptone Bile X – glucurunide) Agar. Plates were incubated at 44 °C for 24 h for enumerating.

S. aureus: S. *aureus* was determined by surface plating on BPA (Baird Parker Agar) supplemented with egg yolk-tellurite emulsion. Spread plates were incubated at 35 °C for 46-48 h. Colonies with typical S. *aureus* morphology were examined microscopically following Gram staining and tested for catalase and coagulase activity.

L. monocytogenes: 25 gr sample has been put in 225 ml BLEB (Buffered Listeria Enrichment Broth Base), incubated for 4 hours in 30°C and after that selective agents and 25 mg/L natamisin has been added in the mediums and incubated for 48 hours in 30°C. At the 24th hour of the incubation period, samples were surface plated on Oxford and Palcam agars. Spread plates were incubated for 48 hours in 35°C.By the end of the 48th hour of the incubation, *Listeria monocytogenes / ivanovii* has been passaged to Chromogenic Listeria Agar Base. Yeast Extract added TSA (trypticase soy agar) passages have been made from the colonies with the *Listeria* spp. suspicion and cultures have been purified. The suspicious isolates have been identified according to gram staining, catalase, motion, dextroglucose, malt sugar, rhamnose, mannitol, xylose fermentation and esculin hydrolization tests for verification.

Salmonella spp.: Samples were pre - enriched in BPW (Buffered Peptone Water). After an incubation period at 37°C for 24 hours, isolates then selectively enriched in RVSB (Rappaport Vassiliadis Soy Broth). Selectively enriched isolates were incubated at 37°C for 24 hours, then enriched cultures were spread plated on Brilliant Green Phenol Red Lactose Sucrose Agar. Besides, XLD (Xylose Lysine Deoxycholate Agar) was also used for verification. Spread plates were inoculated for 24 hours at 37°C and chemical tests were used to identify the suspected colonies. At this stage TSIA (Triple Sugar Iron Agar), urea broth and SIM (Semi Indol Motility) agar were used and identification procedure was completed.

Bacillus cereus: B. cereus were examined by sruface plating on BCA (Bacillus Cereus Agar). Plates were incubated at 37°C for 24 hour for enumerating.

d) *Statistical Analysis*

Mann Whitney U method was used for determining binary relationship correlations and group differences (3).

III. Results

In this study, total 450 houses that were located in three main cities of Thrace region (Edirne, Tekirdağ and Kırklareli / 150 houses for each city) were visited without prior notice and the relations among consuming profile of the public and microbiological quality of the milk products after purchasing period was explored. According to the results we got, cheese was the most preferred dairy product and yoghurt, milk, butter, ice cream and milk cream followed cheese respectively.

It was determined that 16.2% of total samples were contamined coliforms, while 4.3% of the samples were contamined with E. coli, 10.2% of the samples were contaminated with S. aureus, 5.4% of the samples were contaminated with Salmonella spp. and 0.8% of the samples were contaminated with L. monocytogenes and B. cereus in general (detailed data not shown). Table 2

Table 2 : Binary correlations of the microbiological parameters according to Kendall's tau-b correlation analysis method. Bold written characters have positive significant correlations at $p<0.005$ level

		TAB	Coliforms	*E.coli*	*S. aureus*	*Salmonella spp.*	*L. monocytogenes*	*B. cereus*
TAB	Correlation Coefficient	1.000	.880	.425	.677	.478	.181	.181
	Sig.	-------	**.000**	**.000**	**.000**	**.000**	**.001**	**.001**
	N	371		371	371	371	371	371

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Coliforms	Correlation Coefficient	.880	1.000	.483	.504	.381	.206	.206
	Sig.	.000	-------	.000	.000	.000	.000	.000
	N	371	371	371	371	371	371	371
E. coli	Correlation Coefficient	.425	.483	1.000	.147	.478	.277	.277
	Sig.	.000	.000	-------	.005	.000	.000	.000
	N	371	371	371	371	371	371	371
S. aureus	Correlation Coefficient	.677	.504	.147	1.000	.431	.168	.168
	Sig.	.000	.000	.005	-------	.000	.001	.001
	N	371	371	371	371	371	371	371
Salmonella spp.	Correlation Coefficient	.478	.381	.478	.431	1.000	.245	.245
	Sig.	.000	.000	.000	.000	-------	.000	.000
	N	371	371	371	371	371	371	371
L. monocytogenes	Correlation Coefficient	.181	.206	.277	.168	.245	1.000	.664
	Sig.	.001	.000	.000	.001	.000	-------	.000
	N	371	371	371	371	371	371	371
B. cereus	Correlation Coefficient	.181	.206	.277	.168	.245	.664	1.000
	Sig.	.001	.000	.000	.001	.000	.000	-------

Kendall's Tau – b corelation analysis method was used for determining the relationships among the microbiological parameters (Table 2). Due to the results there were positive binary correlations among all the analyzed microbiological parameters and all the parameters were influenced each other to reproduce.

In our study, also, binary relations for all microbiological parameters were determined separately. Thus, group differences among the microbiological parameters were exposed and microbiological "dirtiness" of the cities was determined (Table 3 - 5). According to the results, Kırklareli was the "cleanest" city which was followed by Edirne and Tekirdağ.

Table 3 : In terms of microbiological parameters analysed between Edirne and Kırklareli to compare testing the group differences and microbiologic spread

	TAB	Coliforms	*E. coli*	*S. aureus*	*Salmonella spp.*	*L. monocytogenes*	*B. cereus*
Mann-Whitney U	9548.000	8988.000	9390.000	9603.000	9599.000	9522.000	9522.000
Wilcoxon W	19139.000	18579.000	18981.000	19194.000	19190.000	19113.000	19113.000
Z	-.244	-1.558	-.999	-.172	-.219	-1.407	-1.407
Sig. (2-tailed)	.807	.119	.318	.864	.826	.160	.160

- *There is not significant differences between Edirne and Kırklareli cities in terms of microbiological pollution profile of the houses and spreading of the microbiological parameters ($p>0.005$)*

Table 4 : In terms of microbiological parameters analysed between Edirne and Tekirdağ to compare testing the group differences and microbiologic spread

	TAB	Coliforms	*E. coli*	*S. aureus*	*Salmonella spp.*	*L. monocytogenes*	*B. cereus*
Mann-Whitney U	6412.000	6188.000	6045.000	6204.500	6301.500	6487.000	6487.000
Wilcoxon W	16282.000	10559.000	10416.000	16074.500	10672.500	10858.000	10858.000
Z	-.278	-.960	-2.629	-1.112	-1.081	-.234	-.234
Sig. (2-tailed)	.781	.337	.009	.266	.280	.815	.815

There was significant sifference for E. coli parameter between Edirne and Tekirdağ cities ($p<0.005$). Edirne was significantly "cleaner" than Tekirdağ for E. coli parameter.

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Table 5 : In terms of microbiological parameters analysed between Kırklareli and Tekirdağ to compare testing the group differences and microbiologic spread

	TAB	Coliforms	*E. coli*	*S. aureus*	*Salmonella spp.*	*L. monocytogenes*	*B. cereus*
Mann-Whitney U	6246.000	6288.000	6138.000	6078.000	6252.000	6348.000	6348.000
Wilcoxon W	15837.000	15879.000	10509.000	15669.000	10623.000	15939.000	15939.000
Z	-.496	-.433	-2.033	-1.265	-.898	-1.218	-1.218
Sig. (2-tailed)	.620	.665	**.042**	.206	.369	.223	.223

There was significant sifference for E. coli parameter between Edirne and Kırklareli ities ($p<0.005$). Kırklareli was significantly "cleaner" than Tekirdağ for E. coli parameter

IV. Discussion

Like all foods, dairy products must be purchased carefully and stored correctly up to consuming period, even they are produced, packaged, transported and sold under ideal hygienic conditions. According to the results we got, due to uncorrect consuming habits may cause to increase the initial load of microbiological flora dairy products and / or the dairy products may be contaminated with pathogens rapidly. Thus, dairy products may contaminate each other and / or other kind of foods that are stored in refrigerator and increase the total microbiological load of the refrigerator. This situation is evaluated as an important risk factor for consumers' health.

Cheese was the most preferred dairy product and yoghurt, milk, butter, ice cream and milk cream followed cheese respectively. Dairy products include nearly optimal nutrient elements and because of this reason they can easily contaminate with pathogens under inadequate hygienic conditions from producing to consuming and cheese may serve as an ideal medium for bacterial proliferation because of the absence of competing starter culture, high water activity, protein and fat content. In our study, statistical correlations were exposed among all the analyzed microbiological parameters and it was concluded that explored microbiological parameters induced each other to produce. The reason for this situation may be including of high virulence polymorphic genes and / or transferring the mentioned genes to each other of the pathogens that we explored and forming of more resistant species. Medical literature indicates that some species as *S. aureus* have weak competitive feature and they are generally suppressed in mixed cultures. Additionally, it is also said that lactic acid bacteria in foods prevent growing of pathogens as *E. coli, S. aureus, L. monocytogenes* and *B. cereus*. However, presence of differential proteins said to be relate / interact with other proteins of other pathogens (as *L. monocyogenes)* are being explored by means of developing comparative subproteomic analysis techniques. Before development of subproteomic techniques, it has been considered that asymptomatic pathogen serovars originated from clinical and environmental sources, however now it is being evaluated that pathogen serovars are probably integrated from different serovars by gaining various differential proteins (11). This situation may cause pathogens to develop resistance to antibiotics and / or antimicrobial agents by help of the mobile genetic structures as plasmids and transposons, thus even "safe considered" foods may become a serious risk factor for consumers' health.

Another point that must not be forgotten is; all foods, but especially dairy products may become a serious threat for consumers' health for microbiological aspects if they are not stored and consumed correctly even if they are produced under very best hygienic conditions. According to the results, different microorganisms can easily contaminate the milk and diary products each other which are stored in the refrigerator of houses to be consumed. Thus, total microbiological load of the refrigerator increase and contaminated dairy products risk each other and other foods which are stored in refrigerator.

Cheese was the most preferred dairy product. Microbiological examination of cheese is important for protecting public health, preventing adulteration and developing both internal market and exportation. Various microorganisms exist in the normal flora of cheese. Most of the microorganisms that form microflora of cheese help to develop texture, taste and aroma of the cheese and the aforementioned microorganisms can not survive in gastrointestinal system of human because of its pH values (16). Plate count and lactic acid bacteria values of the cheese are not very important because under normal conditions cheese must have a microbiological flora to be formed. This microflora may vary according to pH value, aging period, humidity level of the cheese (19). Microbiological examination of cheese is important for the foodborne pathogens that threat public health as *S. aureus, E. coli, L. Monocytogenes* and Salmonella spp. (18, 7). Also *S. enteritidis* is one of the most important foodborne pathogens that risk especially short aged and fresh milk based cheese. Aforementioned pathogens can contaminate to cheese via human, different equipments used in producing stages in

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houses and cause serious toxication / infection cases (6). In this study, it was determined *S. aureus* in 8 cheese samples (1.7%), *E. coli* in 4 cheese samples (0.9%), *Salmonella* spp. in 3 cheese samples (0.7%) and *B. cereus* and *L. monocytogenes* in 1 cheese sample (0.2%) respectively. All the positive samples explained above were obtained as open (non – packaged) from the local food bazaars. It is thought that routine controls that would be performed by governments' related authorized offices and applying effective food security systems at every step of cheese producing process would be very important for public health. Another conclusion that was determined was the importance of packaging. The cheese samples which were positive for mentioned foodborne pathogens above, might be produced under hygienic condition and the contamination might be formed because of secondary contamination sources as food contact surfaces, sales staff, equipment and even consumers. Therefore, controlling of foods in place by the specified official staff and applying continuous education programs that would be organized by government especially with the help of visual media and press would be very useful to decrease the incidence of foodborne infections / toxications.

Yoghurt was the "second preferred" dairy product according to the results in our study. Because of its high acidity, it is said to almost any pathogens can grow in yoghurt (13). In this regard, microbiological examinations generally done for existence of antibiotics and to determine morphologically differences of the cultures for yoghurt (20). There are numerous lactic acid bacteria and a little amount of non – pathogen saprophytes in normal microflora of yoghurt (15). Yoghurt was evaluated as the dairy product with minimum risk and all the yoghurt samples were negative for the analyzed microbiological parameters in this study. It is thought that, preferring yoghurt among the dairy products from the sales points whose hygienic status is unclear / unpredictable / suspicious, like restaurants, bazaars and markets would be very effective for decreasing foodborne risk factors for the consumers.

Milk was the "third preferred" dairy product. Raw milk is generally contaminated with various saprophytes and pathogens from primary and secondary contamination sources as animal itself, mammary, staff, equipments used in milking and feces (8). Saprophytes cause to spoil milk and dairy products, while pathogens cause to increase microbiological risk factors for consumers. Because of the reasons mentioned above, it is very important to use high quality raw milk at production process of the dairy products (16). Microbiological quality of raw milk is also very important for consumers' health, too. Probably, raw milk is not convenient for people to consume because of its high rate of pathogens content and various dangerous pathogens as Brucella spp., Salmonella spp., *E. coli, S. aureus,* Streptococcus spp. and Campylobacter spp. may be existed in raw milk (8). However, 41.4% of the houses that are visited indicated that they were providing the milk as open (unpackaged) raw milk from the sales points as open bazaars and directly from the farmers. According to the microbiological analysis of milk samples collected, any microbiological risk factor was detected in the pasteurized milk samples, however, 65% of raw milk samples were evaluated as unsuitable for human consuming from microbiological aspect. The users declared that they heated raw milk until boiling for eliminating the possible pathogens, however heat treatments that are applied in house conditions would not be effective to eliminate all the pathogens in raw milk that threat consumers' health. The pathogens as *E. coli* and *S. aureus,* are toxigenic microorganisms and they may produce high amount of enterotoxins when they reach optimal virulence and the mentioned enterotoxins can not be denaturated by heat treatments. When the percentage of raw milk usage is considered, it can be said that, "milk choice" of the families may cause serious foodborne infections and / or toxications. In this respect, it is thought that formal / governmental studies about integrating food safety education programs to primary, secondary and high schools, determining pilot districts and educating the housewives about food hygiene practices and using educative public spots about food safety in visual media would be very effective to prevent possible foodborne infections and toxications and protecting public health.

Butter was the "fourth preferred" dairy product according to the results. In butter, only certain microorganisms can survive because of its solid structure and salt rate, so butter is quite resistant to microbiological spoilage. Butter contains microscopic water droplets in its fat phase (<10 μm diameter and approximately $5x10^{-10}$ ml. volume) and each droplets cotain nitrogen to survive maximum 10 microorganisms (12). This situation cause butter to have a high resistance. However the mentioned situation also cause butter to be a more risky dairy product for the psychotropic pathogens as *L. monocyotgenes* and *B. cereus*. In our study too, it was detected *L. monocyotgenes* and *B. cereus* in 1 butter sample (0.2%). It is thought that mentioned pathogens not only risk the butter itself, but they may risk all the refrigerator because of their the psychotropic feature.

Ice cream was the "fifth preferred" dairy product. Experimental part of the study were performed in December – January and probably from this reason ice cream was the one of the "least preferred" dairy product. However it is guessed that consumption of ice cream would increase in summer season. For the microbiological examination of ice cream, plate count and coliforms are considered in many countries. In some developed countries besides the explained

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pathogens parameters above, it is obligatory for ice cream to be free also for *L. monocytogenes* ve Salmonella spp. According to Turkish Food Codex, too, at least 25 grams of ice cream must be free from both *L. monocytogenes* and Salmonella spp., and plate count, total coliform group bacteria count, *E. coli, S. aureus* and *B. cereus* must not be more than 2 cfu / ml. (4). Ice cream is generally contaminated by pathogens in the production process via staff, equipments and contact surfaces, but the pathogens hardly grow / survive at the ice cream storage temperatures (14, 16). In our study, 19 ice cream samples (31.7%) were positive for coliforms, 1 sample was positive for *B. cereus* in (0.2%) and 3 samples were positive for *S. aureus* in (5%) respectively. All samples which were positive for the explained parameters above, were isolated from open (unpackaged) purchased ice cream samples. Like all foods, at ice cream processes, it is very important to apply food security systems at every stage to provide the consumers' safe products.

Cream was the "sixth and least preferred" dairy product. The microbiological flora is the most important factor that affect the quality and storage period of cream (1). In this regard, heating and cooling processes must arrange optimally to minimize pathogen growth, because rapid cooling operations cause cream to have physical defects. The microbiological examinations of the raw and cooled milk are the foremost processes to protect public health (10). Coliforms, *S. aureus and* TAB must not be more than 10 cfu / gr, 2 cfu / gr and 10^4 cfu / gr respectively in high quality cream products (4). According to the results we got, 36.6% (11 samples of 30) of the analyzed cream samples were not appropriate for human consuming microbiologically. In our country, cream is generally supplied unpackaged. Cream which is not sold / consumed daily in sales points / houses may be a serious risk factor for human health. Besides, because of its optimal nutrient ingredients, cream can be easily contaminated with various pathogens if it is produced under insufficient hygienic conditions. Due to the results, 35% of the families (157 houses) indicated that they were supplying the cream open, while 58% of the families were purchasing packaged cream. Packaging of foods with appropriate materials (which do not constitute chemical and microbiological risks for consumers' health) by using correct procedures (vacuum, heat treatment, etc.) prevent to grow pathogens significantly (5). Besides, supplying cold chain while transportation, storage and selling, is an another important factor to prevent microorganism growth. In our study, 70% of the unpackaged and 18% of packaged cream samples were evaluated risky for human consuming (data not shown). The reason of pathogen growth in packaged cream may originated from package and / or production processes. Any microbiological risk factors were determined in the cream products which are purchased from the malls and supermarkets.

According to the results, for the analyzed microbiological parameters there were not statistically significant differences between Edirne and Kırklareli, while significant differences were exposed for *E. coli* between Edirne – Tekirdağ and Kırklareli – Tekirdağ cities. Kırklareli was the "cleanest" city and it was followed by Edirne and Tekirdağ. The habits that might be effective on the microbiological quality of dairy products (open purchasing, not considering expiry date of the product, storing the product at the balcony instead of refrigerator, high product stocking and consuming dairy products in long terms, not considering spoilage signs of the products, etc.) were mostly observed in Tekirdağ. And was leastly observed in Kırklareli. Open dairy product purchasing habit was also mostly observed in Tekirdağ when compared with two other cities and according to the results we got Tekirdağ was the first risky city for *E. coli* parameter.

V. Conclusion

Foodborne infections and toxications are widespread all over the world and threat consumers' health seriously. In our study, it was detected that there were correlations between consuming habits and microbiological quality of the dairy product after purchasing period. It is thought that the consciousness – raising programs that would be prepared for public by the related official government institutions and to convey to the public these programs via visual and pressed media, integration of hygiene and food safety programs to especially primary and secondary schools would be very important to decrease the incidence of the pathogens after purchasing period in the houses and to prevent possible outbreaks.

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Electrochemical Evaluation of the Antioxidant Capacity of Moroccan Olive Kernel

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Abstract- The aim of this study was to evaluate the total antioxidant capacity of different Moroccan olive kernel samples by the electrochemical methods. The paper presents the preparation and characterization of the H_2O_2 amperometric sensor and its utilization for antioxidant evaluation of some real olive oil samples from different regions of Morocco. The obtained results were found in good correlation with reality. The analytical calibration graph was recorded for H_2O_2 species. This method was used for determine the antioxidant capacity of olive kernel, obtaining results consistent with their phenol profiles.

Keywords: kernel olive; cyclic voltammetry; antioxidant capacity, square wave voltammetry.

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Electrochemical Evaluation of the Antioxidant Capacity of Moroccan Olive Kernel

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Abstract- The aim of this study was to evaluate the total antioxidant capacity of different Moroccan olive kernel samples by the electrochemical methods. The paper presents the preparation and characterization of the H_2O_2 amperometric sensor and its utilization for antioxidant evaluation of some real olive oil samples from different regions of Morocco. The obtained results were found in good correlation with reality. The analytical calibration graph was recorded for H_2O_2 species. This method was used for determine the antioxidant capacity of olive kernel, obtaining results consistent with their phenol profiles.

Keywords: kernel olive; cyclic voltammetry; antioxidant capacity, square wave voltammetry.

I. Introduction

Virgin olive oil is the primary source of lipids in the Mediterranean diet; it is obtained from the fruit of several olive cultivars, providing oils with different compositions and properties. The compositions of olive oil and its sensorial characteristics besides being strongly dependent on the cultivar are also influenced by several other factors namely climatic and agronomic conditions, time of harvest, and agricultural practices. The virgin olive oils represent a rich source of natural antioxidants such as cinnamic, tyrosol and phenolic compounds. Many of the benefits associated with consumption of phenolic compounds are associated with their antioxidants activities[1, 2], related to their molecular structure[3]. It is reported[13] . Those phenolics may prevent lipid peroxidation via hydrogen atom donation from the hydroxyl group(s) attached to the benzene ring.

Antioxidants are molecules that can delay or even almost prevent the development of oxidation by direct quenching of reactive oxygen species, formed during radical chain oxidation processes.

Reactive oxygen species (ROS) including superoxide anion ($O_2^{\cdot-}$), hydrogen peroxide which is often classified, not as free radical but to reactive oxygen species group, and hydroxyl radical ($OH^{\cdot}$), are generated naturally *in vivo* during metabolic processes, and keeps in a balance level in normal living organisms[4]. However, when a body is subject to the environmental or behavioral stressors (pollution, sunlight exposure, cigarette smoking, excessive alcohol consumption, etc.,), excess ROS are generated[5]. If the excess ROS cannot be scavenged in time, they would attack and induce DNA, proteins and lipids damage, and impede normal cell functions[6]. Therefore, overproduction of ROS is associated with numerous diseases like cancer and Alzheimer's disease, as well as aging. In living systems, the deleterious effects of ROS can be neutralized by the endogenous and exogenous antioxidant systems[7]. Antioxidants are synthetic or natural substances that prevent or delay the oxidative damage by scavenging the free radicals. Fruits and vegetables are good sources of high amounts of known antioxidants.

Several analytical methods have been developed for olive oil total antioxidant capacity assessment. A number of these methods measure the inhibition of stable or an artificially generated radical upon olive oil addition. Spectrometric methods are mainly used in the analysis of antioxidant properties. However, these methods depend on many parameters, such as temperature, time of the analysis, character of a compound or mixture of compounds, concentration of antioxidants, and many other substances[8-10]. Electrochemical methods used for the determination of antioxidant capacity are still developing. These provide rapid, simple and sensitive alternative method in the analysis of bioactive compounds associated with the scavenging of the radicals as well as the antioxidant capacity itself[11-12].

This work aims to map the antioxidant capacity of Moroccan olive kernel according to production region and cultivar.

II. Materials and Methods

a) Apparatus

Electrochemical experiments were performed using a voltalab potentiostat (model PGSTAT 100, Eco Chemie B. V., Utrecht, The Netherlands) driven by the general purpose electrochemical systems data processing software (voltalab master 4 software).

All the electrochemical experiments were performed in a standard one-compartment three-electrode cell. The reference electrode was SCE and the counter electrode was platinum. All electrode potentials

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were referred to this reference electrode. The working electrode was copper modified carbon paste electrode (Cu-CPE).

b) Preparation of the electrochemical electrode

The carbon paste unmodified was prepared by adding paraffin oil to carbon powder and thoroughly hand-mixed in a mortar and pestle. The resulting paste was packed into the electrode and the surface was smoothed. The electrochemical electrode was developed by depositing the copper at fixed potential (0.1 V for 1 hour) onto the carbon paste electrode surface.

c) Reagents and solutions

All chemicals were of the highest quality. Graphite powder (spectroscopic grade RWB, Ringsdorff-Werke GmbH, Bonn-Bad Godesberg, Germany) was obtained from Aldrich, and was used without further purification. $CuSO_4$ was obtained from Merck chemicals. Deionized water was used to prepare all solution.

d) Sample preparation

The fruit samples of Moroccan Picholine, Haouzia and Menara varieties, were collected from different localities in Tadla-Azilal region, at the beginning of January 2015, and were stored at -20 °C until use. After drying in the shade, the kernels were ground to powder in a grinder. The powders were extracted with n-hexane (1:4, w/v) by agitation for 48 h in the dark at room temperature. The solvent was evaporated to dryness in vacuo at 42 °C.

III. Results and Discussion

a) Electrochemical behaviour of prepared electrode

The cyclic voltammograms (CVs) of the copper modified carbon paste electrode (Cu-CPE) and carbon paste electrode (CPE) were recorded in the supporting electrolyte (Na_2SO_4) (Figure 1). We can see that the shape of the cyclic voltammogram was modified in the presence of copper at CPE surface, suggesting that the carbon paste electrode was effectively modified by copper.

The surface structure of copper modified carbon paste surface was observed using scanning electron microscopy (Figure 3). The film layer of copper was formed on the surface of carbon paste electrode; it was not disintegrated or detached from the surface when immersed in the supporting electrolyte solution.

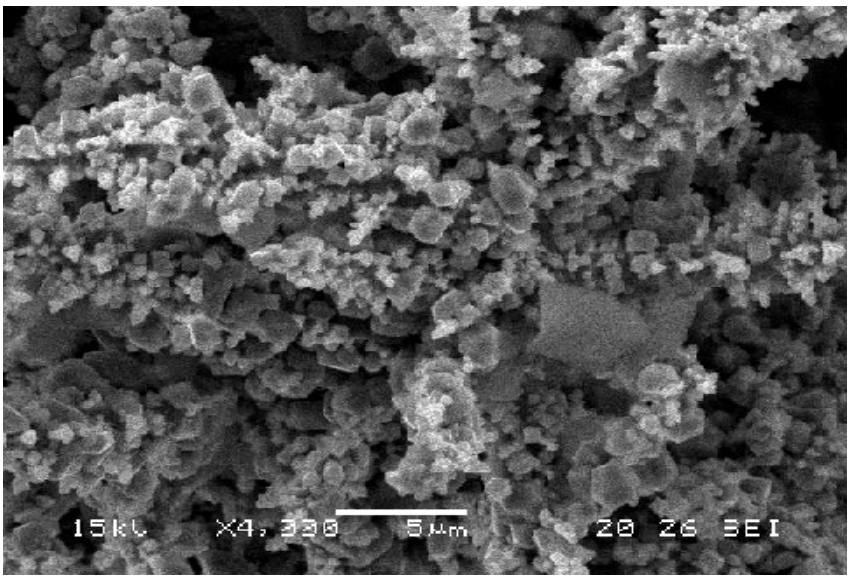

Figure 2 : Scanning electron micrograph of Cu-CPE

b) Calibration graph

The detection of H_2O_2, was examined by square wave voltammetry, in the electrochemical sensor. The electrode response was tested for different amounts of H_2O_2, in the range from 1µL/100mL to 100 µL/100mL (0.1M Na_2SO_4 solution). Figure 3 shows some typical square wave voltammetry curves recorded at Cu-CPE electrode. A calibration graph was then constructed from the observed peak currents. The square wave voltammetric response was almost linearly dependent on the concentration of H_2O_2 (Fig. 4). The linear regression analysis gave:

$$i_p = -0.0014\ [H_2O_2] + 1.2646$$

with a correlation coefficient of 0.9599.

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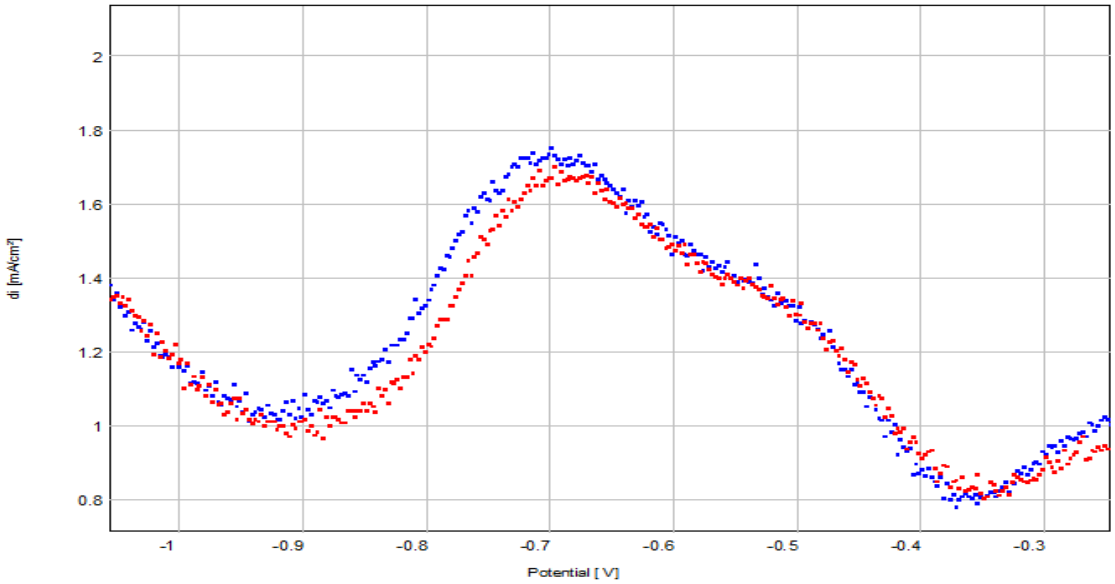

Figure 3 : Square wave voltammograms of H_2O_2, in 0.1M Na_2SO_4 solution pH ≈ 7.4 at Cu-CPE, scan rate 50 mV/s

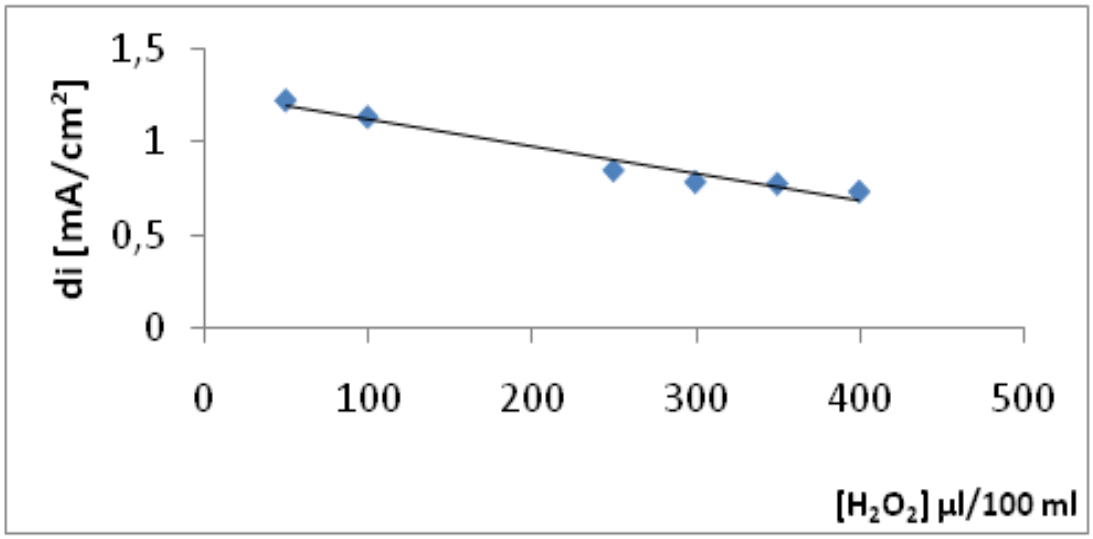

Figure 4 : Calibration graph

c) Antioxidant capacity determination

The anti-oxidant properties of the studied molecules were evaluated, investigating, cyclic voltammetry and square wave voltammetry, by comparing the reduction of H_2O_2.

Preliminary CV experiments were performed to investigate the effect of the addition of a specified quantity of each studied sample to the electrolytic solution containing (50 µL/100 mL) [H_2O_2]. Comparing the three voltammograms, that recorded by Cu-CPE electrode (Figs. 5, 6 and 7), we note that the H_2O_2 reduction peak decrease in the presence of the studied samples. The effect of inhibiting reduction of H_2O_2 varies as follows:

Haouzia sample ≥ Picholine sample > Menara sample

To obtain the results shown in Figure 7, we proceeded as follows:

- Progressive additions, of each the three samples tested, in an electrolytic solution containing H_2O_2,
- the H_2O_2 reduction current densities are determined by square wave voltametry method
- From the calibration graph already drawn (Fig. 4) we determine the amount of H_2O_2 inhibited by the addition of the sample.

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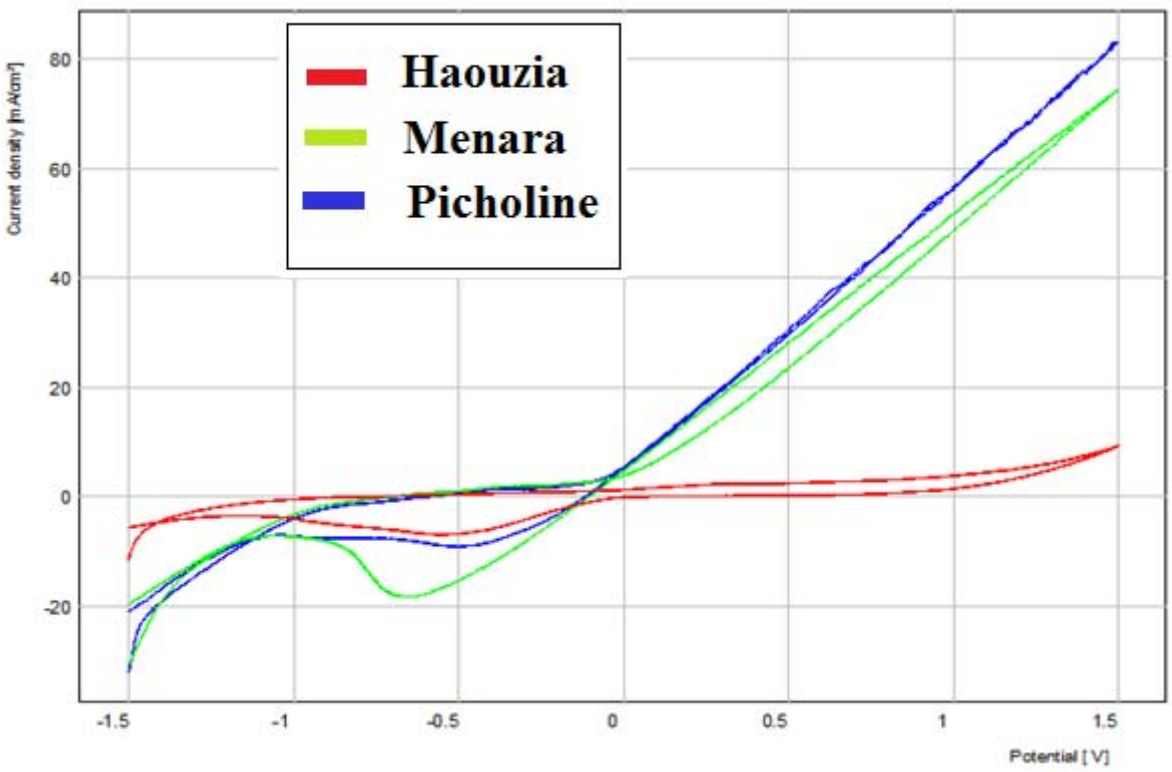

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Figure 5 : Cyclic voltammograms- recorded at Cu-CPE in 0.1M Na_2SO_4, containing 50 µl/100ml of H_2O_2 and 350µl/100ml

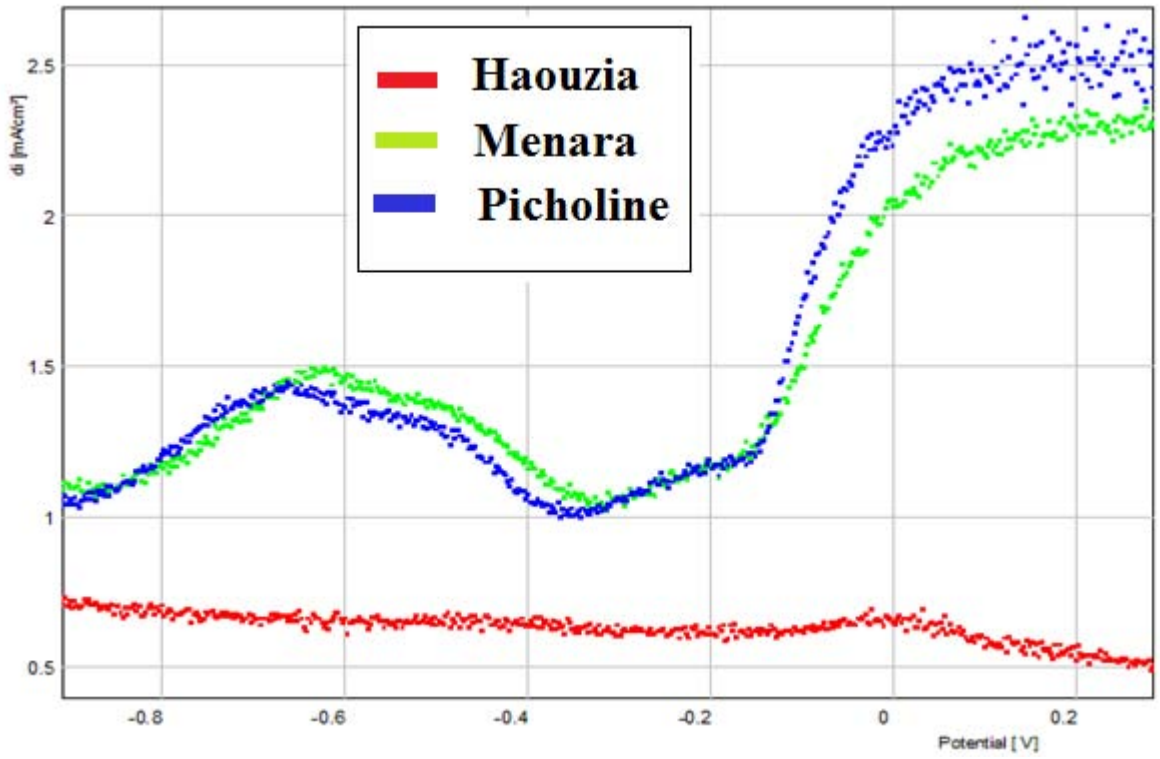

Figure 6 : Square wave voltammograms recorded at Cu-CPE in, 0.1M Na_2SO_4 solution, containing 50 µl/100ml of H_2O_2 and 350µl/100ml

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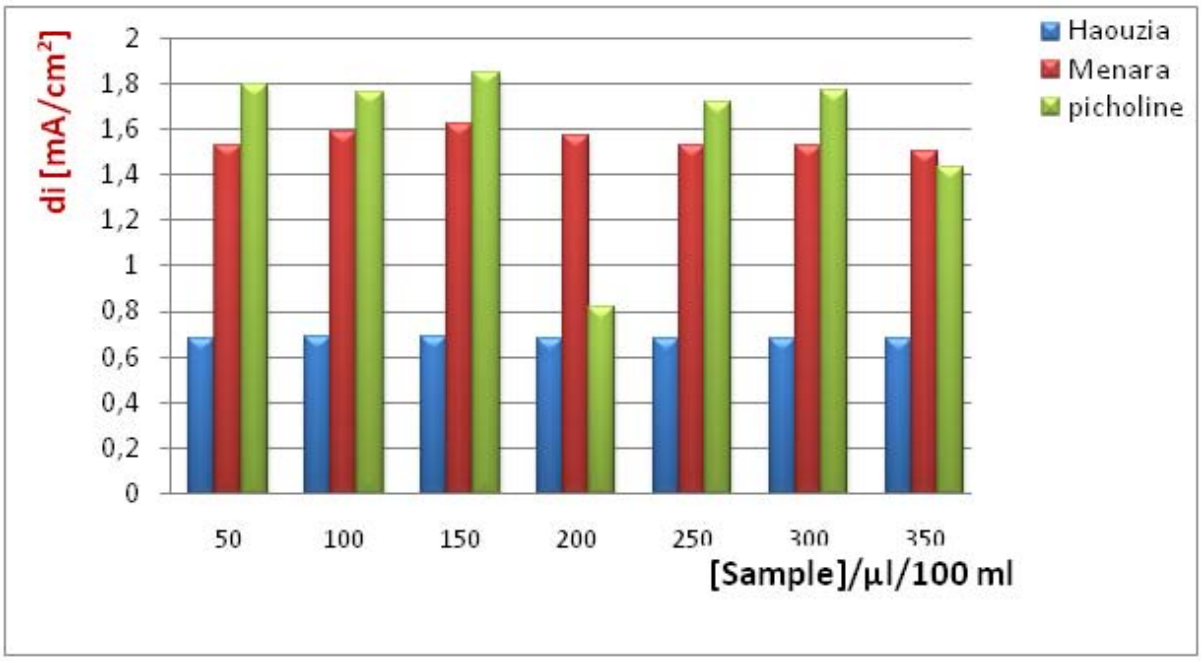

Figure 7 : Evolution of the H_2O_2 reduction current density with the concentration of different studied samples

The corresponding antioxidant capacity (AOC) values, was calculated using the relation:

$$AOC = \frac{I_{H2O2} - I_{H2O2\text{-antioxidant sample}}}{I_{H2O2}} \times 100$$

Where I_{H2O2}, is the current density due to H_2O_2 reduction, and, $I_{H2O2\text{-antioxidant sample}}$, represent the current density due to antioxidant sample addition. The results are summarized in Figure 8.1. The Antioxidant capacity (AOC) of the studied samples varies in the following sense:

Haouzia sample ≥ Picholine sample > Menara sample

Except for a sample concentration near 200 µl, the picholine kernel presents the best antioxidant capacity.

IV. Conclusion

An electrochemical analytical system for the evaluation of the antioxidant capacity has been developed. The main advantage of the new approach is based on coupling the radical analysis and the reduction inhibition of H_2O_2 by the studied kernel oils. The results obtained show that the proposed system is fast, sensitive and better suited than conventional methods.

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Determinant Competitiveness of Lychee Industry in Vietnam

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Abstract- Vietnam has strongly potental to produce variety of fruits such as lychee. However, it lack of a study considering about its competitiveness. Good Agricultural Practices (VietGAP) has been introduced in Bac Giang province since 2008 as pilot area in Vietnam. It is important to know how the VietGAP could promote lychee industry.The estimated Resource Cost Ratios (RCR) from the Policy Analysis Matrix (PAM) showed that Bac Giang province had comparative and competitive advantages. Lychee production with high adoption of VietGAP also had higher comparative and competitive advantages than that with low adoption of VietGAP. Results of the sensitivity analysis indicated that the world price of lychee, lychee yield, and official exchange rate have positive effect on the lychee industry competitiveness while the labor costs, input prices, and interest on capital have negative effect.

Keywords: lychee industry, comparative and competitive advantage, competitiveness, VietGAP.

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Determinant Competitiveness of Lychee Industry in Vietnam

Le Thi Thanh Loan [α], Isabelita M. Pabuayon [σ], Salvador P. Catelo [ρ] & Zenaida M. Sumalde [ω]

Abstract- Vietnam hasstrongly potental to produce variety of fruits such as lychee. However, it lack of a study considering about its competitiveness. Good Agricultural Practices (VietGAP) has been introduced in Bac Giang province since 2008 as pilot area in Vietnam. It is important to know how the VietGAP could promote lychee industry.The estimated Resource Cost Ratios (RCR) from the Policy Analysis Matrix (PAM) showed that Bac Giang province had comparative and competitive advantages. Lychee production with high adoption of VietGAP also had higher comparative and competitive advantages than that with low adoption of VietGAP. Results of the sensitivity analysis indicated that the world price of lychee, lychee yield, and official exchange rate have positive effect on the lychee industry competitiveness while the labor costs, input prices, and interest on capital have negative effect.

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I. Introduction

Bac Giang lychee has good potential for export. Around 32.6% of the total amount of lychee produced in this province was exported in 2011 (Bac Giang Agricultural Office, 2011). This is the biggest amount of lychee export in Vietnam. However, the price of lychee is very low and unstable (Lan, 2010; Vong, 2008; Tru, 2008). This problem may be due to lack of government support for lychee production, harvesting, marketing, and export. Nonetheless, the fact that lychee has export potential may indicate that Bac Giang has comparative and competitive advantages in producing the fruit. If so, there may be justification for the government to support the lychee industry. In particular, it is important to know how the Good Agricultural Practice (VietGAP) could be promoted in the lychee industry. GAP are practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products (FAO, 2002). VietGAP based on the GAP model that consists of 12 sections that cover practices in all four components of food safety; environmental management; workers' health, safety and welfare; and production quality. Bac Giang is the first province in Vietnam to apply VietGAP on lychee production in 2008.If it could be shown that VietGAP improves the competitiveness of the lychee industry, then, it could be promoted among the lychee producers in Bac Giang province.

The objectives of study aimed to determine and compare the comparative and competitive advantages of the lychee industry in Bac Giang province considering VietGAP and non-VietGAP farmers; assess the factors that influence the competitiveness of the lychee industry in Bac Giang province; and provide policy recommendations to improve the competitiveness of the lychee industry in Vietnam.

II. Methodology

a) Selection of the Study Area

The study covered Bac Giang province due to the following reasons: (i) Bac Giang is known as the largest lychee-producing province in Vietnam; and (ii) Bac Giang is a pilot area applying VietGAP on lychee production in Vietnam. The study area covered two major lychee districts in Bac Giang province, Vietnam, namely: Luc Nam (20% of lychee planted area)and Luc Ngan (52% of the total lychee planted area).

Another reason for choosing the two districts is to provide comparison between lychee producers who adopted VietGAP and those who did not. Luc Ngan district has already applied VietGAP in lychee production while Luc Nam has not. Two villages in Luc Ngan, namely, Kep I and Hiep Tan in Hong Son commune where VietGAP has been significantly adopted were chosen. In Luc Nam, two villages were chosen from the list of villages of this district. These villages are Truong Khanh A and Yen Son village. Both villages are located in Dong Hung commune.

b) Types of Data and Sources

Both primary and secondary data were used in this study. Primary data were collected by conducting a survey and personal interviews of the lychee farmers, cooperatives, traders, lychee transporters, and fruit companies in the study area. Key informant interviews of the leaders of groups like cooperatives and other agencies/ organizations in the area were also conducted to gather relevant information. Secondary data were sourced from various government agencies and the internet.

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c) Samping Procedure

Stratified random sampling was applied in choosing the farm samples. 100 respondents were interviewed in the two areas (43 respondents in Luc Ngan district and 57 respondents in Luc Nam district) based on the formula from Aragon, 2010 and Reyes, 2004. Farmers who planted lychee on the same year (1994) were included. This is the common year for growing lychee in both Luc Ngan and Luc Nam districts.

d) Methods of Analysis

The competitiveness of the lychee industry was evaluated using the Policy Analysis Matrix (PAM). PAM was constructed through a double entry bookkeeping method. From the primary data on production and cost, a matrix consisting of revenues, costs and profits at private/financial prices, and social/shadow/economics prices were constructed (Monke and Pearson, 1989).

Comparative Advantage

The important procedure in estimating the comparative advantage of the lychee industry in Vietnam is to compare the DRC with the shadow exchange rate to determine the real values of the activity per hectare of lychee produced. Again, the efficiency measure of comparative advantage is given by the value of Resource Cost Ratio in social prices (RCR) expressed in an equation as follows:

$$RCR = \frac{\text{Domestic Factor Cost at Social Prices (DFs)}}{\text{Difference between the Revenue and Tradable Inputs both in Social Prices}}$$

Thus, if: RCR $<$ 1: the lychee production has a comparative advantage; RCR $=$ 1: the lychee production is comparatively neutral; and RCR $>$ 1: the lychee production has a comparative disadvantage.

Competitive Advantage

Competitive advantage was measured by comparing the domestic resource cost valued at market price (DRC*) with the official exchange rate (OER). Converting the market price DRCs into foreign currency value can indicate whether the production activity of lychee is competitive.

Again, the efficiency measure of competitive advantage is given by the value of Resource Cost Ratio in private prices (RCR^*) per hectare of lychee produced expressed in the following equation:

$$RCR^* = \frac{\text{Domestic Factor Cost at Private Prices (DFp)}}{\text{Difference between the Revenue and Tradable Inputs both in Private Prices}}$$

Thus, if: RCR* $<$ 1: the lychee production has a competitive advantage; RCR* $=$ 1: the lychee production is competitively neutral; and RCR* $>$ 1: the lychee production has a competitive disadvantage.

Sensitivity Analysis

To estimate the degree of responsiveness of the lychee industry competitiveness, the study used the elasticity of RCR and RCR^* indicating the response to a change in the level of each of the factors, namely, lychee FOB price, price of inputs, interest on capital, official exchange rate, labor cost, and lychee yield. Each factor was adjusted to vary by 1 percent assuming all other factors constant to determine the corresponding effect on the RCR and RCR^* values. Theoretically, RCR elasticity is computed as follows (ADB, 1993):

$$Ed = \frac{\text{\% change in RCR}}{\text{\% change in RCR component or parameter}}$$

$$Ed = \frac{\delta RCR}{\delta D} * \frac{D}{RCR}$$

Where: Ed is the elasticity of the RCR response to each of the components or parameters such as lychee FOB price, price of inputs, interest on capital, official exchange rate, labor cost, and lychee yield. δRCR is the change in RCR and δD is the change in RCR component parameter.

III. Results and Discussions

In order to apply the PAM approach, the production cost items were estimated in both quantities and unit prices to measure the extent of price distortions and to analyze the impact of price changes on different cost components tradable and non – tradable. To be consistent, all production cost items and lychee output were expressed on per hectare basis.

Three main steps were followed in setting up the PAM: (a) calculation of physical inputs and output, (b) derivation of farm budget in private and social prices for the items identified in step (a), and (c) setting up a PAM from information in step (b).

a) Physical Input – Output Relationships

Both VietGAP and non – VietGAP lychee farmers applied nitrogen (N) and potassium (K) as imported fertilizers. However, Vietnam has the ability to produce phosphorous (P) domestically. This is the reason why phosphorous price is not affected by the world price like nitrogen or potassium. Aside from the three tradable inputs like nitrogen, phosphorous, and potassium, the lychee farmers used chemical pesticide for their lychee orchard. They also applied composted manure which they produced from the animal wastes.

Table 1 shows the quantities of the different inputs in lychee production and the output on per hectare basis for VietGAP farmers in Luc Ngan district and non – VietGAP farmers in Luc Nam district. The amount of composted manure used in Luc Nam district was greater than in Luc Ngan by about 350 kg per hectare. According to the farmers in Luc Nam district, the composted manure was cheap and it was quite easy when they could get it from animal wastes. Thus, they would not consume so much money on buying

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other expensive fertilizers like nitrogen, phosphorous, and potassium.

The volume of tradable fertilizers applied in Luc Ngan district was higher than in Luc Nam district. The amount of phosphorous applied on VietGAP lychee orchard was around 547.50 kg per hectare but only 300 kg phosphorous per hectare in non – VietGAP farms in Luc Nam district. The VietGAP farmers in Luc Ngan district applied about 285 kg potassium which was more than twice that was applied by non - VietGAP farmers. However, the lychee farmers in Luc Nam district applied slightly more chemical pesticide than farmers in Luc Ngan district. Almost all non – Viet GAP respondents in Luc Nam district said they sprayed chemical on lychee orchard whenever they saw their neighbors applied it.

Physical labor plays an important role in the lychee industry. Except for weeding, more labor was employed in VietGAP lychee orchards than in non – VietGAP farms. The farm activities of VietGAP farmers are time – consuming such as in creating canopy and pruning, fertilizer and chemical application, and harvesting and post harvest operations. Surprisingly, even though the non – VietGAP farmers applied higher amount of chemical they consumed less time to spray than VietGAP farmers. This means that while the VietGAP farmers used less chemical pesticide, they devoted more time for spraying according to their plan.

Table 1 : Input – Output data for lychee production per hectare

Item	Unit	VietGAP	Non-VietGAP
I. Total costs			
A. Production inputs			
1. Fertilizer			
Composted manure	kg	1,500	1,850
Nitrogen (N)	kg	85.43	50
Phosphorus (P)	kg	547.5	300
Potassium (K)	kg	285	100
2. Chemical	liter	42.72	45
3. Labor			
Land preparation	Man days	15.08	15
Create a canopy, pruning	Man days	31.09	18
Fertilizer application	Man days	44.95	22.6
Chemical application	Man days	43.22	30.7
Weeding	Man days	4.93	5.02
Harvesting and post -harvest	Man days	156.67	100
4. Transporting and loading	Thous. VND	1,947.2	1,520.7
B. Equipment depreciation			
Pump	Unit/ Season	0.14	0.3
Sprayer	Unit/ Season	0.15	0.2
Sickle	Unit/ Season	0.94	0.47
Canvas	Unit/ Season	0.85	0
Other containers	Unit/ Season	0.56	0.17
Lychee orchard depreciation	Thous. VND	13,450	13,450
C. Other expenses			
Electricity and water	Thous. VND	274.57	245
Interest on capital	Thous. VND	31,366	22,792
Land	ha	1	1
II. Output	kg	13,638.76	12,550.03

Source: Primary survey.1USD = 20,608 VND

The lychee farmers in Bac Giang province were still using poor facilities and equipment for lychee production. The main types of equipment used in both districts were pump, sprayer, sickle, and other containers like polystyrene container. The difference in equipment depreciation between VietGAP farmers and non – VietGAP farmers was small. However, almost all VietGAP farmers used canvas to keep lychee clean after harvest while the non – VietGAP farmers did not use this.

The lychee orchard depreciation was 13,450,000 VND per hectare. This was adopted from the study of Diep (2007) which was also conducted in Bac Giang province and covered the farmers that have grown lychee since 1994. Lychee is the perennial crop. The life cycle of lychee includes initial period and harvest period. Trees take 3 to 5 years to come into production and will not produce substantial crops until the seventh or eighth year. Hence, the lychee orchard depreciation was assumed to be equal to total cost invested during the initial period divided by 8 years.

Electricity was used to pump water to the lychee orchard. There is a small difference in the amount of

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money paid for the two groups of farmers. The capital needed by VietGAP farmers was higher than that by non – VietGAP farmers. Thus, VietGAP farmers paid higher interest than non – VietGAP farmers with 31,366,000 VND and 22,792,000 VND, respectively. Most farmers in the two districts had to borrow capital from the Agricultural Bank.

Table 1 also shows that the VietGAP lychee farmers had higher productivity of 13,639 kg per hectare than non - VietGAP farmers with 12,550 kg per hectare.

b) Financial Prices of Inputs and Output

Table 2 shows the financial prices for lychee industry in Bac Giang province. Financial price is the prevailing price in the market which is competitive and a result of the negotiation between sellers and buyers without any outside intervention.

For the fertilizer, chemical, and equipment, according to the respondents, the market price increased slightly in 2011. For labor, the wage rate was 120 thousand VND per day. It is higher than in 2010 by about 20 thousand VND per day because of inflation in 2011.

Interest on capital was derived from the interest rate charged by the Agricultural bank in 2011. The interest rate was 16.17% per year. The market price of capital was assumed as the interest rate of borrowing from the main lending source. For land, the market price is zero since the farmers did not rent the land. They used their own orchard to produce lychee.

Fresh lychee had quite a high price in 2011. The market price of VietGAP lychee was 13.73 thousand VND, higher than the 8.22 thousand VND for the non – VietGAP lychee.

Table 2 : Financial prices of inputs and output for the lychee industry

Item	Unit	Price
I. Total costs		
A. Production inputs		
1. Fertilizer		
Composted manure	1,000 VND/ kg	2.9
Nitrogen (N)	1,000 VND/ kg	9.2
Phosphorus (P)	1,000 VND/ kg	3
Potassium (K)	1,000 VND/ kg	12
2. Chemical	1,000 VND/liter	206
3. Labor		
Land preparation	1,000 VND/Man days	120
Create a canopy, pruning	1,000 VND/Man days	120
Fertilizer application	1,000 VND/Man days	120
Chemical application	1,000 VND/Man days	120
Weeding	1,000 VND/Man days	120
Harvesting and post -harvest	1,000 VND/Man days	120
4. Transportation		-
B. Equipment depreciation		
Pump	1,000 VND/ Unit	2,000
Sprayer	1,000 VND/ Unit	3,000
Sickle	1,000 VND/ Unit	300
Canvas	1,000 VND/ Unit	300
Other containers	1,000 VND/ Unit	600
Lychee orchard depreciation	1,000 VND	-
C. Other expenses		
Electricity and water	1,000 VND	
Interest on capital	%	16.17
Land	ha	-
II. Output		
VietGAP lychee	1,000 VND/ Kg	13.73
Non – VietGAP lychee	1,000 VND/ Kg	8.22

Source: Primary survey. 1USD = 20,608 VND

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c) *Social Prices of Inputs and Output*

Table 3 : Social prices of inputs and output for the lychee industry

ITEM	UNIT	PRICE
I. Total costs		
A. Production inputs		
1. Fertilizer		
Composted manure	1,000 VND/ kg	2.9
Nitrogen (N)	1,000 VND/ kg	11.9
Phosphorus (P)	1,000 VND/ kg	3
Potassium (K)	1,000 VND/ kg	16.23
2. Chemical	1,000 VND/liter	224.48
3. Labor		
Land preparation	1,000 VND/Man days	90
Create a canopy, pruning	1,000 VND/Man days	90
Fertilizer application	1,000 VND/Man days	120
Chemical application	1,000 VND/Man days	120
Weeding	1,000 VND/Man days	90
Harvesting and post -harvest	1,000 VND/Man days	120
4. Transportation		
B. Equipment depreciation		
Pump	1,000 VND/ Unit	2166
Sprayer	1,000 VND/ Unit	3249
Sickle	1,000 VND/ Unit	325
Canvas	1,000 VND/ Unit	300
Other containers	1,000 VND/ Unit	600
Lychee orchard depreciation	1,000 VND	
C. Other expenses		
Electricity and water	1,000 VND	
Interest on capital	%	1.02
Land	ha	82627
II. Output		
VietGAP lychee	1,000 VND/ Kg	17.06
Non – VietGAP lychee	1,000 VND/ Kg	11.34

Source: Primary survey. 1USD = 20,608 VND

Using social valuation methodology, private prices of the tradable inputs, output, non – tradable inputs, and domestic factors such as land, labor, and capital were conveted to social prices. The summary of social prices of inputs and output are shown in Table 3.

The composted manure as a non - traded item which has a social price equal to market price multiplied by SCF (0.9), resulted to 2.61 thousand VND per kg. Nitrogen and potassium known as traded inputs were converted using the import parity prices. Phosphorous is an input that was produced by a supply industry operating near full capacity, hence the market price of the input is its economic value. The social price of phosphorous was equal to 3 thousand VND per kg. The chemical pesticide was assumed as indirectly traded item with 80.38% imported component and 19.62% local component. Its social price was 224.48 thousand VND per liter.

As a domestic factor, the social price of labor was computed by multiplying market price of labor with SCF. The social price of labor was 81 thousand VND and 108 thousand VND in the normal season and peak season, respectively. Hence, the social price of capital was 1.02% per year. The social price of land was obtained by multiplying the net profit of orange amounting to 82,627 thousand VND per ha with a SCF of 0.9. The result was 74,364 thousand VND per ha which was used for the social price of land. Orange was assumed as the competitive crop of lychee in Bac Giang province.

The social price of lychee output in the 2 districts was equivalent to the export parity price. The values were 17.06 thousand VND and 11.34 thousand VND in Luc Ngan district and Luc Nam district, respectively.

d) *Budgets of Lychee Industry at Private and Social Prices*

Based on the tables of private prices and social prices of inputs and output for lychee industry, Tables 4 and 5 were constructed.

Table 4 shows the budget of lychee industry at private prices. The costs of harvesting, chemical and fertilizer application, and lychee orchard depreciation were significant in the total cost of lychee production in both districts.

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The total private cost of VietGAP lychee was higher than that of non – VietGAP lychee. However, the private profit from VietGAP lychee was twice greater than that of non VietGAP lychee due to much higher private revenue.

Since the land cost of 74,364 thousand VND per hectare was absent in the private price budget, the total private cost was much lower than the total social cost in both districts. However, both total revenue and total cost at social prices were higher in Luc Ngan than in Luc Nam district.

Table 4 : Budget of the lychee industry at private prices *(thousand VND/ hectare)*

ITEM	LUC NGAN DISTRICT	LUC NAM DISTRICT
I. Total costs		
A. Production inputs		
1. Fertilizer		
Composted manure	4,350	5,365
Nitrogen (N)	786	460
Phosphorus (P)	1,642	900
Potassium (K)	3,420	1,200
2. Chemical	8,804	9,273
3. Labor		
Land preparation	1,809	1,800
Create a canopy, pruning	3,730	2,160
Fertilizer application	5,394	2,712
Chemical application	5,186	3,684
Weeding	591	602
Harvesting and post -harvest	18,800	12,000
4. Transportation	1,947	1,520
B. Equipment depreciation		
Pump	280	600
Sprayer	450	600
Sickle	282	140
Canvas	255	0
Other containers	336	100
Lychee orchard depreciation	13,450	13,450
C. Other expenses		
Electricity and water	274	245
Interest on capital	5,072	3,685
Land	-	-
II. Output		
Total revenue	187,295	103,161
Total cost	76,863	60,498

Source: Primary survey. 1USD = 20,608 VND

There is a big difference in profit in the two districts. In Luc Ngan district where the farmers applied VietGAP, profit at social price was very much higher than in Luc Nam district. In fact, the social profit of non – VietGAP farmers in Luc Nam district was even lower than their private profit at 15,033 thousand VND and 42,663 thousand VND, respectively.

Table 5 : Budget of the lychee industry at social prices *(thousand VND/ hectare)*

ITEM	LUC NGAN DISTRICT	LUC NAM DISTRICT
I. Total costs		
A. Production inputs		
1. Fertilizer		
Composted manure	3,915	4,828
Nitrogen (N)	1016	595
Phosphorus (P)	1,642	900
Potassium (K)	4,626	1,623
2. Chemical	9,590	10,101
3. Labor		
Land preparation	1,221	1,215
Create a canopy, pruning	2,518	1,458
Fertilizer application	4,854	2,440

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Chemical application	4,668	3,315
Weeding	399	406
Harvesting and post -harvest	16,920	10,800
4. Transportation	1,752	1,368
B. Equipment depreciation		
Pump	295	633
Sprayer	475	633
Sickle	297	147
Canvas	57	0
Other containers	75	90
Lychee orchard depreciation	12,105	12,105
C. Other expenses		
Electricity and water	247	220
Interest on capital	288	208
Land	74,365	74,364
II. Output		
Total revenue	232,657	142,376
Total cost	141,333	127,457

Source: Primary survey. 1USD = 20,608 VND

e) *Competitiveness of the Lychee Industry in Bac Giang Province*

Based on the budget tables (Tables 4 and 5), the PAM was determined for VietGAP and non – VietGAP lychee farmers. Table 6 shows the revenues, costs, and profits of lychee industry in Bac Giang province at private and social prices, for Luc Ngan and Luc Nam districts, and for high and low adoption VietGAP farmers in Luc Ngan district.

Table 6 : Policy Analysis Matrix (PAM) for the lychee industry *(thousand VND/ hectare)*

ITEM	REVENUE	COST OF INPUTS		PROFIT
		Tradable	Non-Tradable	
Private prices (A)				
Luc Ngan district	187,295	15,411	61,451	110,431
High adoption VietGAP	204,391	14,500	62,448	127,442
Low adoption VietGAP	166,141	15,566	61,187	89,386
Luc Nam district	103,161	12,838	47,659	42,663
Social prices (B)				
Luc Ngan district	232,657	17,698	123,634	91,324
High adoption VietGAP	253,122	16,156	124,758	112,207
Low adoption VietGAP	209,456	17,776	123,766	67,913
Luc Nam district	142,376.	14,308	113,148	14,918
Divergences (A-B)				
Luc Ngan district	-45,362	-2,287	-62,183	19,107
High adoption VietGAP	-48,731	-1,656	-62,310	15,235
Low adoption VietGAP	-43,314	-2,210	-62,579	21,473
Luc Nam district	-39,214	-1,470	-65,489	27,745

Source: Primary survey. Note: 1USD = 20,608VND

It can be observed in Table 6 that the divergences between private and social revenues are all negative implying that society earned an additional 45,362 thousand VND and 39,214 thousand VND per hectare of lychee in Luc Ngan district and Luc Nam district, respectively. So, when the farmers applied VietGAP, the society could earn more from the lychee industry. It is shown more clearly by the output transfer of high adoption VietGAP and low adoption VietGAP. With high extent of adoption of VietGAP, the society earned an additional 48,731 thousand VND. With low extent of adoption of VietGAP, the additional gain of society was 43,314.77 thousand VND.

Both private profit and social profit are significantly positive showing that the lychee industry in Bac Giang province is profitable for the producers. Furthermore, when the farmers adopted VietGAP on lychee production, they could earn more profit, both in social and private prices. With high adoption of VietGAP, producers gained 3 times and 7 times more than without adoption of VietGAP at private prices and social prices, respectively.

Comparative Advantage

To determine the comparative advantage of the lychee industry in Bac Giang province, two indicators, namely, Resource Cost Ratio (RCR) and Net Social Profit (NSP) are presented in Table7.

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Table7 : Indicators of comparative advantage of the lychee industry

ITEM	RCR	NSP (thous.VND/ha)
Luc Ngan district (VietGAP adoption)	0.58	91,324
High adoption	0.53	112,207
Low adoption	0.65	67,913
Luc Nam district (Non - VietGAP adoption)	0.88	14,918

Source: Primary survey. Note: 1USD = 20,608VND

The RCR values in terms of social prices are all less than one indicating that Bac Giang province has comparative advantage in lychee production. The RCR values are 0.58 and 0.88 in Luc Ngan district and Luc Nam district, respectively. These results mean that in Luc Ngan district where VietGAP was applied, comparative advantage was higher compared to Luc Nam district where VietGAP was not applied. High adoption of VietGAP resulted in lower RCR value compared to low adoption of VietGAP. This indicated that comparative advantage was higher where VietGAP adoption was also higher.

Competitive Advantage

Table 8 shows the RCR* and NPP in terms of private prices.For both districts, the lychee industry has competitive advantage since all RCR* values are less than one.

Table 8 : Indicators of competitive advantage of the lychee industry

ITEM	RCR*	NPP (thous.VND/ha)
Luc Ngan district (VietGAP adoption)	0.36	110,431
High adoption	0.33	127,442
Low adoption	0.41	89,387
Luc Nam district (Non - VietGAP adoption)	0.53	42,663

Source: Primary survey. Note: 1USD = 20,608VND

The RCR* values using private prices are smaller than the RCR values using social prices. This is because the farmers did not have to pay for the land. This also explains the higher NPP values in Table 8 compared to those in Table 7.

Luc Ngan district where VietGAP was being adopted has higher competitive advantage than Luc Nam district where VietGAP has not been adopted yet. Higher competitive advantage was also consistent with higher adoption of VietGAP. The high VietGAP adopters gained the highest NPP from the lychee industry.

f) Effects of Changes in Various Factors on the Lychee Industry Competitiveness

Sensitivity analysis was carried out in this sub-section to test the robustness of theresults under the baseline scenario, that is, from Tables 7 and 8 The RCR and RCR* elasticity coefficients were computed to estimate the degree of responsiveness of the comparative and competitive advantages to a change in the level of each of the various factors. These factors are lychee FOB price, exchange rate, imported input prices, labor cost, interest on capital, and lychee yield. Each was adjusted to vary by 1 percent to determine the corresponding effect on the RCR and RCR* values and therefore on the degree of competitiveness.

Table 9 shows that RCR was most sensitive to changes in the official exchange rate, lychee FOB price, and lychee yield. The elasticity of RCR with respect to change in the official exchange rate was – 1.38 and – 0.88 in Luc Ngan district and Luc Nam district, respectively. It means that when the official exchange rate increases by one percent, the RCR will decrease by 1.38% and 0.88% in Luc Ngan and Luc Nam district, respectively. Thus, the increase in the official exchange rate tends to help the lychee farmers gain more comparative advantage. Hence, the devaluation of the domestic currency of Vietnam will increase lychee comparative advantage. However, the increase in official exchange rate influences only the social price of inputs and output leaving the private prices unaffected.

The elasticity of RCR with respect to a change in the lychee FOB price was - 1.07 and -1.27 in Luc Ngan district and Luc Nam district, respectively. These values indicate that a one percent increase in the lychee FOB price led to a decrease in RCR value of 1.07% and 1.27% in Luc Ngan district and Luc Nam district, respectively. This factor also affected RCR only while leaving RCR* unaffected.

The lychee yield was another important factor affecting competitiveness. A one percent increase in lychee yield will lead to a decrease in RCR value of 0.88% and 0.76% percent in Luc Ngan district and Luc Nam district, respectively. This factor also affected the RCR* since it has an effect on the private budget of lychee industry. A one percent increase in lychee yield

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will decrease RCR* by 1.03% and 0.73% in Luc Ngan district and Luc Nam district, respectively. This means that higher productivity of lychee will improve both the comparative and competitive advantages of lychee industry in Bac Giang province.

Table 9 : The RCR and RCR* elasticities of the lychee industry

Factor	District	E Rcr	Effect On The Lychee Comparative Advantage	E Rcr*	Effect On The Lychee Competitive Advantage
Lychee FOB price	Luc Ngan	-1.07	+	n/a	n/a
	Luc Nam	-1.27	+	n/a	n/a
Input prices	Luc Ngan	0.09	-	0.12	-
	Luc Nam	0.08	-	0.24	-
Interest on capital	Luc Ngan	0.04	-	0.08	-
	Luc Nam	0.02	-	0.08	-
Labor cost	Luc Ngan	0.26	-	0.61	-
	Luc Nam	0.17	-	0.52	-
Offical exchange rate	Luc Ngan	-1.15	+	n/a	n/a
	Luc Nam	-1.38	+	n/a	n/a
Lychee yield	Luc Ngan	-0.88	+	-1.03	+
	Luc Nam	-0.76	+	-0.73	+

Source: Primary survey Note: n/a means not affected.

In addition to the above factors, labor cost is also important especially in Luc Ngan district where the elasticity of RCR is equal to 0.26; higher than in Luc Nam district where the elasticity is 0.17. The positive sign of the elasticity of RCR in this case means that a one percent increase in labor cost will lead to an increase of 0.26% and 0.17% in the RCR value for Luc Ngan district and Luc Nam district, respectively. This factor has a strong effect on RCR* with quite high elasticity of RCR*. A one percent increase in labor cost will decrease competitive advantage in Luc Ngan district and Luc Nam district. This could be explained by the fact that labor becomes inadequate during the peak demand season of harvesting and chemical or fertilizer application. When labor demand exceeds labor supply, labor cost becomes higher. The lack of labor during the harvesting season causes the farmers to lose the chance to sell their product. The revenues both at private and social prices will decrease resulting in lower competitiveness of lychee industry in the province.

The input prices and the interest rate on capital can also be explained in the same way as labor cost. These factors affect both the comparative and competitive advantages of the lychee industry. A one percent increase in all input prices of lychee production will lead to a decrease of 0.09% and 0.08% in RCR and 0.12% and 0.24% in RCR* in Luc Ngan district and Luc Nam district, respectively. The increase in input prices had a strong affect on the competitive advantage of lychee industry in Luc Nam district where farmers do not adopt VietGAP and apply inputs like chemical pesticide and fertilizer. Interest on capital is also a factor affecting the lychee competitiveness. A one percent increase in the interest rate will lead to a decrease of 0.04% and 0.02% in RCR in Luc Ngan district and Luc Nam district, respectively. The same will lead to a decrease of 0.08% in RCR* in both districts.

IV. Conclusions and Recommendations

It can be concluded that when the farmers apply VietGAP, the society can earn more from the lychee industry. With high adoption of VietGAP, the society earned an additional 48,731 thousand VND. Comparatively, with low adoption of VietGAP, the additional earning was 43,314 thousand VND per hectare. The values of RCR and RCR* were less than one in the two districts which clearly show that the lychee industry in Bac Giang province has comparative and competitive advantages. Luc Ngan district where VietGAP was applied had greater comparative advantage than Luc Nam district where VietGAP was not applied. The RCR values were 0.58 and 0.88 in Luc Ngan and Luc Nam district, respectively. Similarly, based on the lower RCR* value, Luc Ngan district had higher competitive advantage than Luc Nam district. Lychee production with high adoption of VietGAP also had higher competitive advantage than that with low adoption of VietGAP. Results of the sensitivity analysis showed that the major determinants of the lychee industry competitiveness are lychee FOB price, official exchange rate, lychee yield, labor cost, input prices, and interest on capital. The world price of lychee, lychee yield, and official exchange rate have positive effect on the lychee industry competitiveness. The positive effect of the official exchange rate means that domestic currency devaluation could increase lychee competitiveness and export. Three other factors, namely, labor costs, input prices, and interest on capital have negative effect on lychee industry competitiveness. The study recommended improving the VietGAP program implementation and the input distribution system; providing processing support, insurance fund, greater access to capital, and better equipment and

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tools for lychee production; and encouraging membership to lychee farmers' group.

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Changing Some of Composition and Properties Podzolic Soils of an Average Taiga of West Siberia when Introduced Eastern Galega (Galega Orientalis Lam.).

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Abstract- The article examines the impact of eastern galega on some indicators of composition and properties of podzolic soils in the conditions of the middle taiga of Western Siberia. It is shown that in the early stages of development of eastern galega is depleted soil organic matter and some deterioration of its properties, but in the future restoration of soil trend indicators. Especially intensively these processes are at sowing galega east under cover of peas and in the application of microbiological preparation Baikal-EM1.

Keywords: galega orientalis, the introduction of inoculation, baikal EM1, sandy podzolic, middle taiga of western siberia, soil fertility.

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Изменение Некоторых Показателей Состава И Свойств Подзолистых Почв Средней Тайги Западной Сибири При Интродукции Галеги Восточной (*Galega Orientalis* Lam.).

Changing Some of Composition and Properties Podzolic Soils of an Average Taiga of West Siberia when Introduced Eastern Galega (Galega Orientalis Lam.).

Moiseeva E. A. [α], Shepelev A. I [σ], Shepeleva L. F [ρ] & Bashkatova J. V. [ω]

Abstract- **В статье рассматривается влияние галеги восточной на некоторые показатели состава и свойств подзолистых почв в условиях средней тайги Западной Сибири. Показано, что на первых этапах развития галеги восточной происходит обеднение почвы органическим веществом и некоторое ухудшение ее свойств, но в дальнейшем прослеживается тенденция восстановления почвенных показателей. Особенно интенсивно эти процессы проходят при посеве галеги восточной под покров гороха и при применении микробиологического препарата Байкал-ЭМ1.**

Abstract- The article examines the impact of eastern galega on some indicators of composition and properties of podzolic soils in the conditions of the middle taiga of Western Siberia. It is shown that in the early stages of development of eastern galega is depleted soil organic matter and some deterioration of its properties, but in the future restoration of soil trend indicators. Especially intensively these processes are at sowing galega east under cover of peas and in the application of microbiological preparation Baikal-EM1.

Ключевыеслова: галега восточная, интродукция, инокуляция, байкал-эм1, песчаные подзолистые почвы, средняя тайга западной сибири, плодородие почвы.

Keywords: galega orientalis, the introduction of inoculation, baikal EM1, sandy podzolic, middle taiga of western siberia, soil fertility.

Актуальность исследования. Биологическое земледелие становится приоритетным направлением в повышении плодородия и восстановлении нарушенных почв за счет применения биологических препаратов и сидеральных культур. Особенно это необходимо в условиях интенсивно используемых (техногенно нарушенных) земель, к которым необходимо отнести территорию Западной Сибири.

Эти обстоятельства определяют острую необходимость введения в культуру растений, обладающих высокой экологической пластичностью, ценными биологическими и биогеоценотическими свойствами, и поэтому толерантных к техногенным загрязнениям.

По мнению многих исследователей, одной из перспективных культур для интродукции в различных почвенно-климатических условиях, является галега восточная (козлятник восточный) (*Galega orientalis* Lam.). Козлятник может произрастать на почвах с низким содержанием гумуса и кислой реакцией почвенного раствора [1]. Это высокопродуктивное многолетнее бобовое растение отличается высокой зимостойкостью – переносит бесснежные зимы с температурой до –40 °С, и холодостойкостью (заморозки до –5…–8 °С). Активное формирование фитомассы галеги в первые годы вегетации, как утверждает ряд авторов [2, 3], ухудшает показатели плодородия и снижает содержание питательных веществ (содержание органики, кислотность, обменные основания и т.д.) Мощная корневая система корнеотпрыскового типа позволяет растению самовозобновляться вегетативным путем, улучшать агрофизические свойства почвы и за счет создания благоприятных водного, теплового и воздушного режимов, повышать ее плодородие [4].

В регионе были предприняты отдельные попытки изучения возможности возделывания галеги восточной. При этом оценивались общие эколого-биоморфологические особенности развития культуры и результаты интродукции в первый год жизни в условиях Сургутского района Ханты-Мансийского автономного округа [5]. Однако для определения

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перспективности выращивания здесь этой культуры необходимо изучать не только особенности ее роста и развития, но и её влияние на состав и свойства почв с учетом почвенно-климатических условий округа.

В связи с этим основная **цель** данной работы состояла в определении характера изменения основных агрохимических показателей подзолистых почв и оценке биогеоценотических свойств галеги восточной при интродукции в почвенно-климатических условиях тайги Западной Сибири.

Материалы и методика исследования. Полевой стационарный микроделяночный опыт был заложен в 2013 г. на территории Ханты-Мансийского автономного округа (пгт. Барсово Сургутского района), относящейся к прохладному, значительно увлажненному району возделывания весьма ранних культур [6]. Исследуемый участок окультуренный, характеризовался песчаной подзолистой почвой: содержание массовой доли органического вещества 5,63 %, pH сол. – 5,21, сумма поглощенных оснований – 4,7 ммоль /100 г почвы, N-NH_4 – 3,85 мг/ кг почвы, N-NO_3 – 129 мг/кг почвы, P_2O_5 – 396,1 мг/ кг почвы, K_2O – 66,5 мг/кг почвы.

Объектом исследования послужила галега восточная, выращенная на песчаной подзолистой почве Сургутского района. Опыт проводился по общепринятой методике [7], площадь учетной делянки составляла 0,25 м^2 и включал следующие варианты: 1) посев неинокулированных семян (контроль); 2) посев инокулированных семян; 3) посев неинокулированных семян галеги под покров гороха.

Предпосевную инокуляцию семян микробиологическим удобрением Байкал-ЭМ1 проводили согласно рекомендации по применению препарата. Скарифицировали и высевали культуру вручную. Глубина заделки семян 1,5–2 см.

Почвенные образцы отбирали в начале и в конце сезона вегетации растений. Химический анализ проводили в агрохимической лаборатории ФГБУ «САС «Марийская»». Погодные условия вегетационных периодов 2013–2014 гг. в целом были характерными для данной территории, однако по влагообеспеченности вегетационный сезон 2013 г. отмечен как засушливый. Количество осадков по данным метеостанции г. Сургута было на 41 мм меньше средней суммы за вегетационный период (342 мм). Распределение осадков по месяцам происходило равномерно. Только в августе зафиксировано небольшое отклонение от среднемесячной нормы (69 мм), которое составило 6,33 мм. Вегетационный сезон 2014 г, напротив, характеризовался как избыточно увлажненный. Количество выпавших осадков было на 81 мм больше средней нормы за вегетационный период (342 мм). Необходимо отметить неравномерное распределение осадков на протяжении периода июнь–октябрь. Максимальное количество осадков выпало в августе – на 74 мм больше средней нормы. Октябрь, напротив, был засушливый и осадков зафиксировано на 15 мм меньше средней нормы.

Результаты исследования и обсуждение. Исследования химического состава и некоторых свойств подзолистых почв Сургутского района, при интродукции галеги восточной показали, что разные агротехнические приемы посева культуры оказали неодинаковое влияние на характер изменения состава и свойств почв и на рост и развитие культуры.

Установлено, что за весь период ни на одном из исследуемых вариантов опыта не было зафиксировано массовой доли органического вещества в почве выше исходного уровня (рис. 1). Содержание органики в пахотном слое в 2014 г., в сравнении с весной 2013 г., уменьшилось на 42 % в контрольном варианте опыта; на 36 % - при применении микробиологического препарата Байкал-ЭМ1 и на 25 % при посеве галеги под покров гороха. Хотя в целом, за два года интродукции галеги восточной статистически достоверных различий в содержании органического вещества по вариантам опыта не зафиксировано ($\acute{\alpha} < 0,05$).

В целом же нужно констатировать общее снижение органического вещества в почвах в первый год интродукции, возможно, за счет усиления микробной активности почвы под влиянием жизнедеятельности галеги восточной.

Применение микробиологического препарата Байкал-ЭМ1 и посев галеги под покров гороха к концу второго года исследований положительно сказались на изменении физико-химических показателей (кислотность почвенного раствора и сумма поглощенных оснований) почвы.

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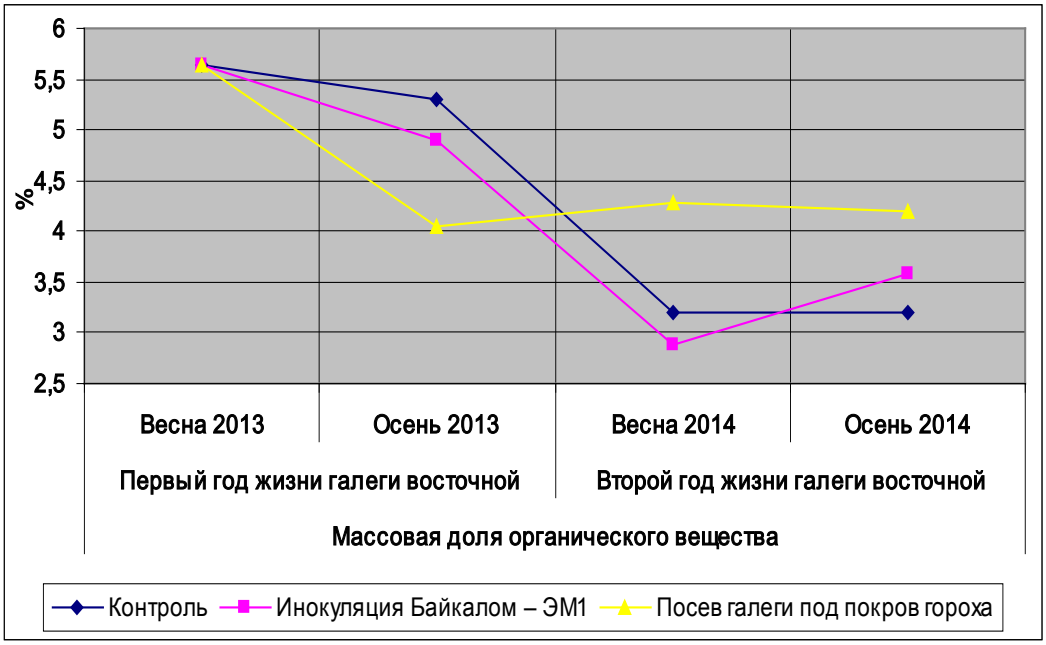

Рис. 1 : Содержание массовой доли органического вещества в почве (0–20 см) в посевах галеги восточной в зависимости от приемов выращивания, % (среднее за 2013–2014 гг.)

Изучаемые приемы возделывания галеги восточной не смогли противостоять процессу подкисления почвы пахотного горизонта в первый год интродукции культуры. Так, к осени 2013 г. отмечено значительное подкисление почвы по всем вариантам опыта, по сравнению с исходными показателями (рис. 2). Посев галеги с горохом способствовал минимальному увеличению кислотности почвы, которая составила 4,28 ед., что на 9 % выше, чем в остальных вариантах опыта, где показатели pH почвы существенно не отличались между собой (3,9–3,95 ед. pH).

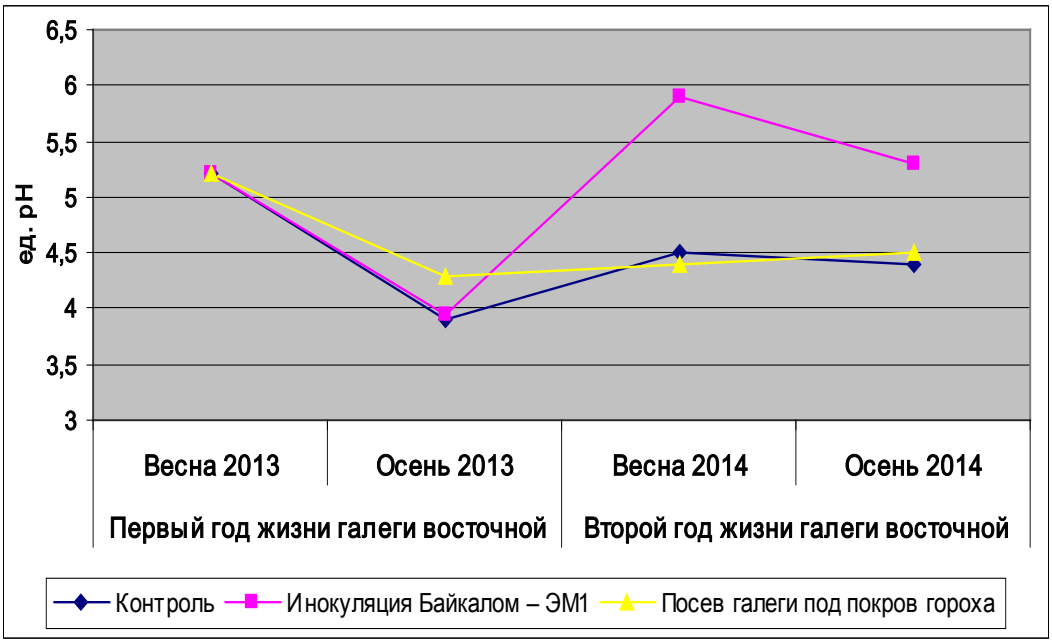

Рис. 2 : Кислотность солевой вытяжки, ед. pH в почве (0–20 см), в посевах галеги восточной в зависимости от приемов выращивания (среднее за 2013–2014 гг.)

К концу вегетационного периода 2014 года отмечено восстановление pH почвы во всех исследуемых образцах. Инокуляция семян галеги привела к стабилизации кислотности почвенного

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раствора до исходного уровня (5,3 ед. pH). На контроле и в варианте с посевом галеги под покров гороха отмечено менее интенсивное восстановление pH почвы (4,4–4,5 ед. pH).

Количество поглощенных оснований в почве к осени 2013 года существенно снизилось по всем вариантам опыта, по сравнению с началом вегетационного периода (рис. 3). Наименьшее снижение суммы поглощенных оснований зафиксировано при посеве галеги под покров гороха – 2,7 ммоль/100 г почвы, что на 37–26 % выше, чем показатели в остальных вариантах опыта. Значения суммы оснований в контрольном варианте и при применении Байкала-ЭМ1 существенно не отличались между собой и составляли 2–1,7 ммоль / 100 г почвы.

Заметное увеличение суммы поглощенных оснований к осени 2014 года произошло на вариантах с посевом инокулированных семян (7,5 ммоль/100 г почвы) и при покровном посеве галеги (6,2 ммоль/100 г. почвы) по сравнению с контрольными растениями (3,9 ммоль/100 г почвы) (ά > 0,05), что возможно свидетельствует об интенсивной минерализации растительных остатков.

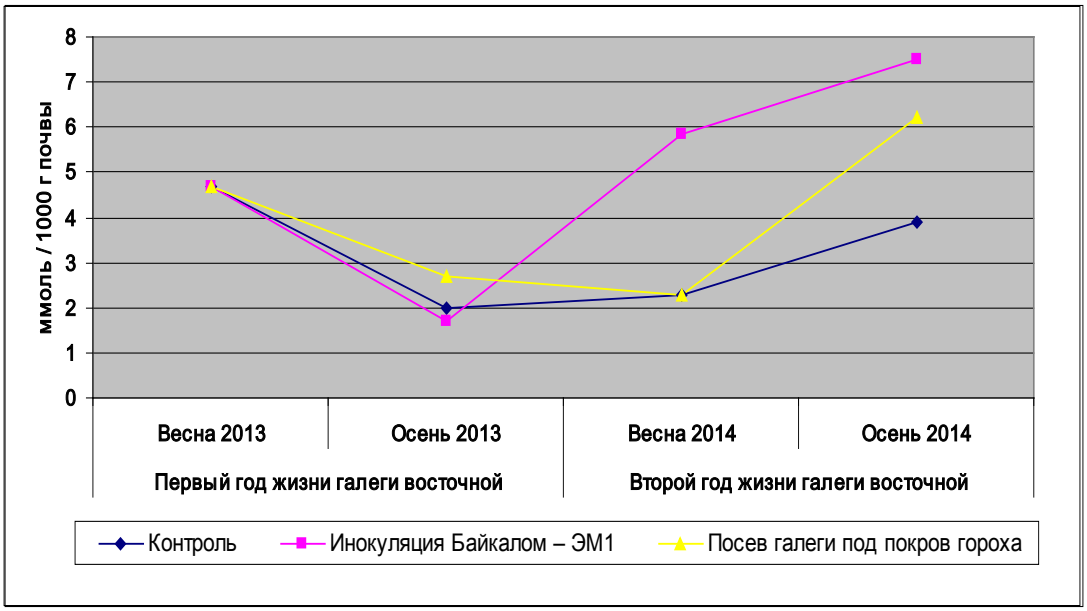

Рис. 3 : Сумма поглощенных оснований в почве (0–20 см), ммоль/100 г почвы в посевах галеги восточной в зависимости от приемов выращивания (среднее за 2013–2014 гг.)

Двухлетние наблюдения показали, что под действием покровной культуры гороха аммонификация в почве протекала более интенсивно, чем в остальных вариантах опыта (ά > 0,05). Покровный посев галеги оказал положительное влияние на накопление обменного азота аммония в почве в первый год, далее наблюдалось снижение. В остальных двух вариантах опыта накопление $N\text{-}NH_4$ зафиксировано только ко второму году жизни галеги восточной (рис. 4).

Осенью 2013 г. содержание $N\text{-}NH_4$, в варианте с посевом галеги под покров гороха составило 5,19 мг/кг почвы, т.е. произошло повышение содержания аммонийного азота в почве на 45 %, по сравнению с исходным значением (весна 2013 г) (ά > 0,05). По-видимому, пополнение почвы пожнивно-корневыми остатками гороха способствовало увеличению доли азота аммония в год посева за счет активизации процессов минерализации азотсодержащих органических соединений. Содержание $N\text{-}NH_4$ в почве под контрольными растениями уменьшилось на 77 %, при инокуляции семян галеги – на 44 %, что свидетельствует об интенсивном процессе перехода аммонийного азота в нитратную форму (0,83 и 2,02 мг/кг почвы, соответственно).

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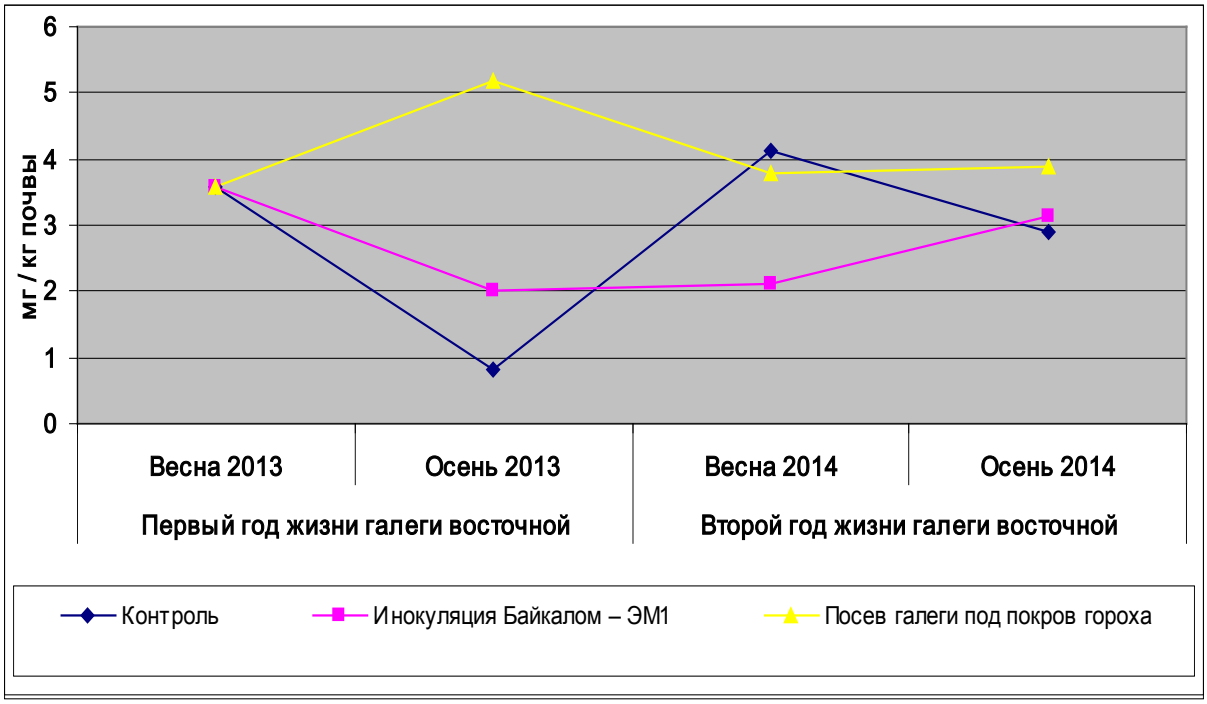

Рис. 4 : Содержание аммонийного азота в почве (0–20 см) в посевах галеги восточной в зависимости от приемов выращивания, мг/кг почвы (среднее за 2013–2014 гг.)

К концу второго года возделывания галеги восточной отмечена тенденция к накоплению $N\text{-}NH_4$ в пахотном слое в вариантах опыта с контрольными растениями и при применении Байкала-ЭМ1, что объясняется более растянутыми сроками аммонификации растительных остатков. В то же время, в варианте посева галеги с горохом зафиксировано снижение содержания данной формы азота до исходных показателей (3,87 мг/кг почвы) и уменьшение составило 25 % по сравнению с осенью 2013 года.

За два года наблюдений отмечена тенденция уменьшения содержания нитратного азота в пахотном горизонте по всем вариантам опыта (рис. 5).

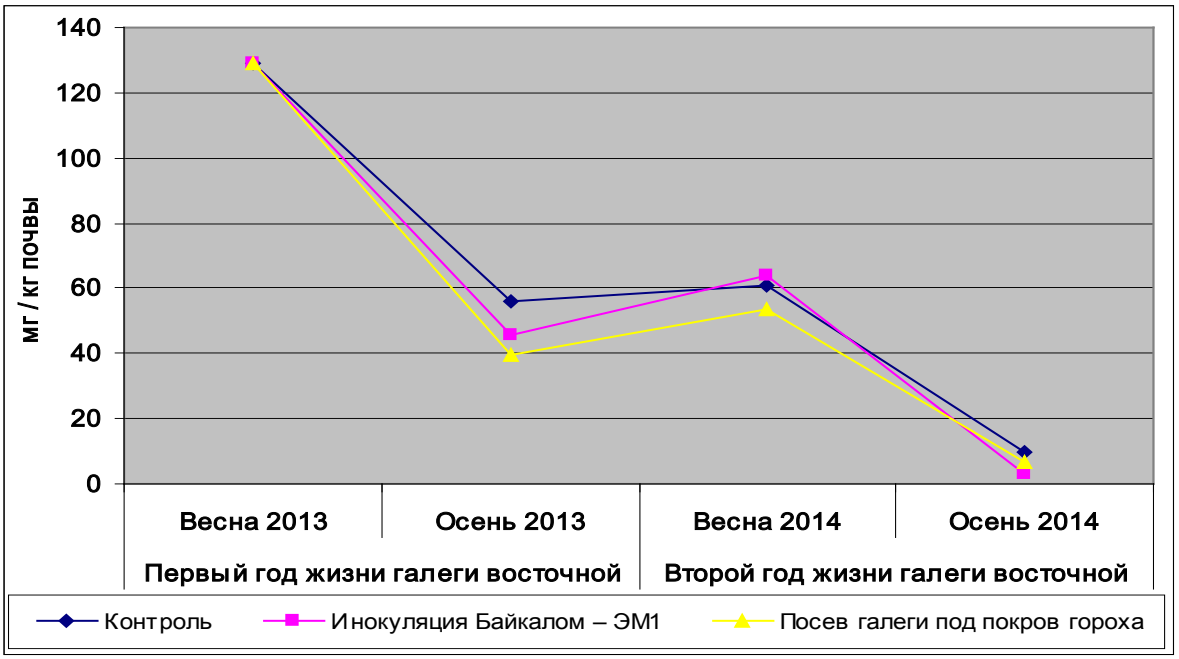

Рис. 5 : Содержание нитратного азота в почве (0–20 см) в посевах галеги восточной в зависимости от приемов выращивания, мг/кг почвы (среднее за 2013–2014 гг.)

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Самыми требовательными к содержанию $N\text{-}NO_3$ в почве оказались растения галеги, семена которой инокулировали перед посевом Байкалом-ЭМ1, и содержание этой формы азота в почве уменьшилось на 97 % (3,3 мг/кг почвы), по сравнению с исходными показателями почвы (129 мг/кг почвы).

Так, к концу вегетационного периода 2013 года, наибольшее накопление $N\text{-}NO_3$ было отмечено в контрольном варианте опыта (56,2 мг/кг почвы), наименьшее – при посеве галеги под покров бобовой культуры (39,8 мг/кг почвы). Скорее всего, это связано с расходованием нитратной формы азота на рост и развитие гороха и интенсивными процессами аммонификации (см. рис. 4).

К осени 2014 года наблюдалось резкое уменьшение уровня содержания $N\text{-}NO_3$ по всем вариантам опыта. Минимальное снижение количества нитратной формы азота зафиксировано в почве, где произрастали контрольные растения (10 мг/кг почвы). Посев галеги под покров гороха не оказал существенного влияния на величину содержания $N\text{-}NO_3$ в почве осенью 2014 г. ($\acute{\alpha} < 0,05$) по сравнению с посевом контрольных растений, в то время как применение Байкала-ЭМ1 снизило содержание нитратного азота ($\acute{\alpha} > 0,05$) достоверно. Опыт возделывания галеги за 2 года позволяет сделать вывод о положительном влиянии этой культуры на содержание в пахотных горизонтах подвижных форм фосфора.

К концу вегетационного периода 2013 года содержание подвижных форм фосфора в исследуемой почве различалось по вариантам опыта (рис. 6). Наблюдалось незначительное увеличение, на 3,5 %, P_2O_5 при посеве контрольных растений (382,2 мг/кг почвы) и при посеве инокулированных семян (374,2 мг/кг почвы) – на 1,4 %. Покровный посев галеги, напротив, привел к достоверному снижению уровня содержания подвижного фосфора на 31% по сравнению с исходными показателями (255,3 мг/кг почвы) ($\acute{\alpha} > 0,05$). Это, вероятнее всего, обусловлено более активным биологическим потреблением фосфора покровной культурой.

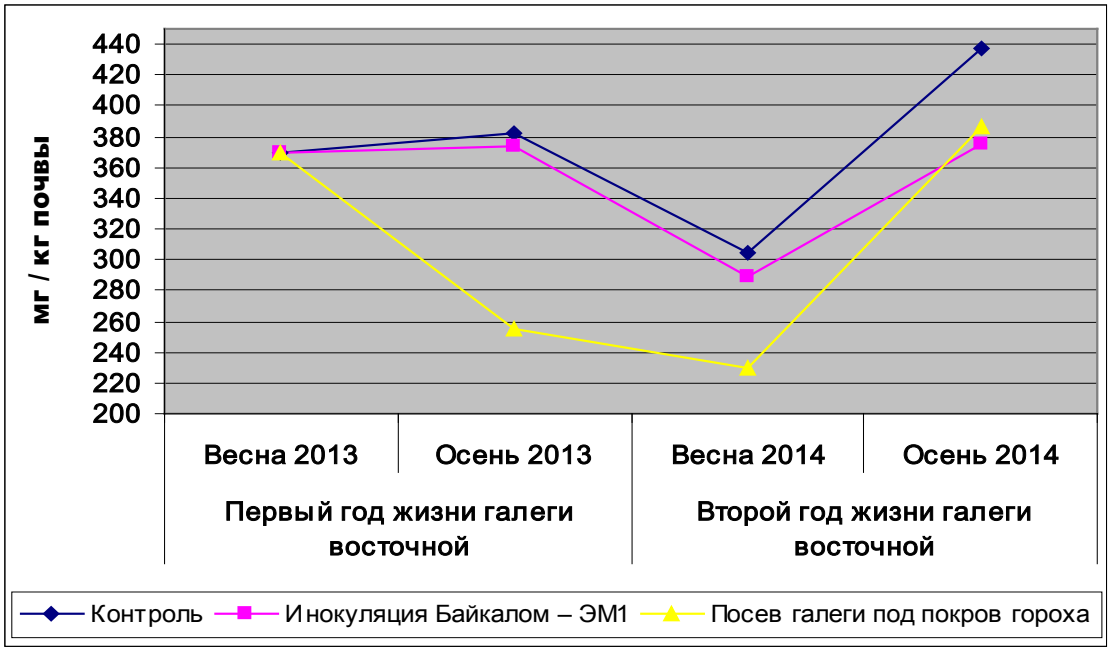

Рис. 6 : Содержание подвижного фосфора в почве (0–20 см) в посевах галеги восточной в зависимости от приемов выращивания, мг/кг почвы (среднее за 2013– 2014 гг.)

К осени 2014 года по всем вариантам опыта отмечена тенденция к накоплению P_2O_5 в пахотном горизонте. Особенно интенсивно этот процесс наблюдался при бинарном посеве галеги с горохом. Содержание подвижной формы фосфора увеличилось на 51 % по сравнению с осенью 2013 года и на 4,6 % – по сравнению с весной 2013 года (386 мг/кг почвы). В варианте опыта с посевом контрольных растений зафиксировано постепенное увеличение количества фосфора от осени к осени (на 14,3 %) и от весны 2013 к осени 2014 (на 18,4 %) (437 мг/кг почвы). При применении Байкал-ЭМ1 существенных различий в содержании P_2O_5 от осени к осени и от исходных показателей к осени 2014 года не отмечено (375 мг/кг почвы).

Сезонные изменения содержания обменного калия в почве, зафиксированные в 2013–2014 гг., по всем вариантам опыта были идентичны данным подвижности фосфора (рис. 7). В целом по опыту, содержание K_2O в почве за годы исследования снизилось на 53–68 %, по сравнению с исходными показателями (66,5 мг/кг почвы). Наименьшее отрицательное влияние на уменьшение K_2O в почве ($\acute{\alpha}$

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> 0,05) оказала покровная культура гороха (31 мг/кг почвы).

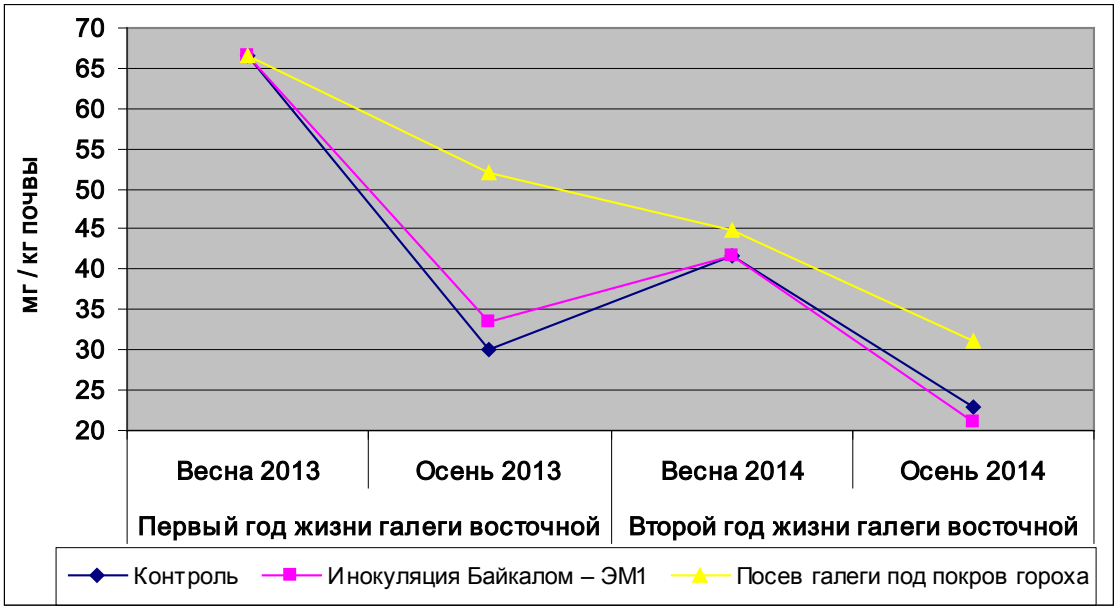

Рис. 7 : Содержание обменного калия в почве (0–20 см) в посевах галеги восточной в зависимости от приемов выращивания, мг/кг почвы (среднее за 2013–2014 гг.)

Так, к осени 2013 года содержание обменного калия в почве по всем вариантам опыта уменьшилось на 22–54 % по сравнению с началом вегетационного периода. В вариантах с посевом контрольных растений и растений, выращенных из инокулированных Байкалом-ЭМ1 семян, данные показатели существенно не отличались между собой (30 и 33,4 мг/кг почвы). Максимальное значение K_2O отмечено при посеве галеги под покров гороха (52 мг/кг почвы). Возможно, это связано с усилением микробиологического процесса в этом варианте опыта.

Содержание обменного калия, в зависимости от варианта опыта, к осени 2014 года по сравнению с осенью 2013г., снизилось на 23–40 %. Минимальное уменьшение наблюдалось в контрольном варианте опыта (23 мг/кг почвы) – на 23 %, на варианте с инокуляцией семян микробиологическим удобрением (21 мг/кг почвы) – на 37 %. В варианте с покровным посевом галеги уменьшение содержания K_2O составило 40 % (31 мг/кг почвы).

Проведенный анализ показал, что посев галеги на подзолистых почвах способствовал максимальному использованию калия, содержащегося в пахотном горизонте почвы. Однако, за два года исследований, посев козлятника под покров гороха обеспечил наименьшее снижение количества обменного калия в почве, которое составило 53 % по сравнению с весной 2013 года. В то же время, в контрольном варианте опыта снижение произошло на 65 %, при посеве инокулированных семян – на 68 %.

В целом можно сказать, что зеленая масса гороха, в варианте с подсевом его под галегу, способствовала увеличению подвижности калия и мобилизации его в пахотном горизонте по сравнению с остальными вариантами опыта. При этом, за счет повышения содержания органического вещества почвы (см. рис. 1), эффект последействия сидерата отмечается и на второй год.

Заключение. Результаты исследований биогеоценотических свойств галеги восточной позволяют считать ее перспективной культурой для возделывания на песчаных подзолистых почвах в условиях средней тайги Западной Сибири. На первых этапах развития галеги восточной происходит обеднение почвы органическим веществом и некоторое ухудшение ее свойств, что объясняется расходованием питательных веществ на рост и развитие растений, но в дальнейшем прослеживается тенденция восстановления почвенных показателей. Особенно интенсивно эти процессы проходят при посеве галеги восточной под покров гороха и при применении микробиологического препарата Байкал-ЭМ1.

Таким образом, можно полагать, что галега восточная, обладая широким биогеоценотическим потенциалом и экологической пластичностью к неблагоприятным условиям среды, может стать перспективной культурой для возделывания на песчаных подзолистых и на техногенно нарушенных почвах.

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Nutritional Values of Smoked *Clarias Gariepinus* from Major Markets in Southwest, Nigeria

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Abstract- Smoked *Clarias gariepinus* from four major markets in the southwest, Nigeria were analyzed. The aim was to evaluate the nutritional values of the fish sold at the different markets. The results of the analyses showed that the nutritional values of the smoked fish are of good standard but nutritional and mineral compositions varied from market to market. The moisture content, protein, fat, fibre, ash and carbohydrate contents from the markets were in the range of 9.63 to 10.27%, 53.77 to 54.77%, 11.77 to 13.13%, 6.87 to 8.00%, 0.0 to 0.07% and 15.40 to 16.17% respectively. The range of the mineral compositions was 10.13 to 12.17mg/100g, 0.33 to 0.50mg/100g, 28.33 to 46.67mg/100g, 353.33 to 388.33mg/100g, 22.33 to 33.33mg/100g, and 271.67 to 305.00mg/100g for iron, zinc, magnesium, calcium, potassium and phosphorus respectively. Ascorbic acid, thiamine, niacin and riboflavin contents of the fish were in range of 0.17 to 0.27mg/100g, 0.05 to 0.07mg/100g, 0.24 to 0.28mg/100g, and 0.05 to 0.08mg/100g respectively.

Keywords: *smoked fish, markets, southwest, clarias gariepinus, nutritional values.*

GJSFR-D Classification : *FOR Code: 079999*



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Nutritional Values of Smoked *Clarias Gariepinus* from Major Markets in Southwest, Nigeria

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Abstract - Smoked *Clarias gariepinus* from four major markets in the southwest, Nigeria were analyzed. The aim was to evaluate the nutritional values of the fish sold at the different markets. The results of the analyses showed that the nutritional values of the smoked fish are of good standard but nutritional and mineral compositions varied from market to market. The moisture content, protein, fat, fibre, ash and carbohydrate contents from the markets were in the range of 9.63 to 10.27%, 53.77 to 54.77%, 11.77 to 13.13%, 6.87 to 8.00%, 0.0 to 0.07% and 15.40 to 16.17% respectively. The range of the mineral compositions was 10.13 to 12.17mg/100g, 0.33 to 0.50mg/100g, 28.33 to 46.67mg/100g, 353.33 to 388.33mg/100g, 22.33 to 33.33mg/100g, and 271.67 to 305.00mg/100g for iron, zinc, magnesium, calcium, potassium and phosphorus respectively. Ascorbic acid, thiamine, niacin and riboflavin contents of the fish were in range of 0.17 to 0.27mg/100g, 0.05 to 0.07mg/100g, 0.24 to 0.28mg/100g, and 0.05 to 0.08mg/100g respectively. There were significant differences ($P < 0.05$) in the proximate, vitamin and mineral compositions between the paired samples from the markets. These variations could be explained as due to the different smoking devices employed, the duration and methods of storage and the effects of different fish handlers after smoking. It is therefore recommended that good smoking and storage methods should be adopted as well as maintenance of hygienic environment and practices by smoked fish handlers.

Keywords: smoked fish, markets, southwest, clarias gariepinus, nutritional values.

I. Introduction

Fish makes up about 60% of world protein supply and developing countries derive more than 30% of their annual protein from fish (FAO 1994). Teutscher (1990) and Saisithi (1994) reported that fish provides between 30% and 80% of the total animal protein intake of the coastal people of West Africa. In Nigeria fish constitute 40% of animal protein intake (Olatunde, 1998). Fish demand is increasing as a result of the increasing world population, higher living standards and the good overall image of fish among consumers (Cahu *et al*., 2004). In addition, the demand for fish is on the increase due to the health benefits of eating fish and due to increase in human population, the rinderpest disaster, and drought bane, which reduce the availability and affordability of red meat (Oshozekhai and Ngueku, 2014). Fish and fish products are highly nutritious with protein content of 15 to 20% and are particularly efficient in supplementing the cereal and tuber diets widely consumed in Africa (Fagbenro *et al*., 2005). Kreuzer and Heen (1962); Waterman (1976); Olomu (1995); Ojutiku *et al*. (2009) also highlighted that fish is rich in protein with amino acid composition very well suited to human dietary requirements comparing favorably with egg, milk and meat in the nutritional value of its protein. Fish also contains absorbable dietary minerals (Bruhiyan et al., 1993). In Nigeria, fish is eaten fresh and smoked and form a much cherished delicacy that cut across socio-economic, age, religions and educational barriers (Adebayo et al., 2008) and it is a rich source of protein commonly consumed due to the higher cost of meat and other sources of animal protein (Omolara and Omotayo, 2009). However, fish is highly perishable because it provides favourable medium for the growth of microorganisms after death (Aliya *et al*., 2012; Oparaku and Mgbenka, 2012). An estimate of 40% postharvest losses of total fish landings have been reported in Nigeria (Akande, 1996). Fish spoilage in Nigeria is influenced to a large extent by high ambient temperatures, considerable distances of landing ports to points of utilization and poor as well as inadequate infrastructure for postharvest processing and landing (Saliu, 2008). Thus, it is imperative to process and preserve some of the fish caught in the period of abundance, so as to ensure an all year round supply. This will invariably reduce postharvest losses, increase the shelf-life of fish, and guarantee a sustainable supply of fish during off season with concomitant increase in the profit of the fishermen (Eyo, 1997). Proper preservation starts the moment fish is harvested until reaches the consumer's table (Oluborode *et al*., 2010). A number of processing techniques is in operation in Nigeria. These include chilling, freezing, salting, canning, drying and smoking. However, smoking is the most popular method of fish processing (Eyo, 2000) and among the several methods of long term preservation of fish, smoking is perhaps the simplest method as it does not require sophisticated equipment or highly skilled workers (Olayemi *et al*., 2011). Smoked-dried fish is the most acceptable form of fish product in Nigeria (Stolyhiro and Sikorski, 2005; Yanar, 2007). Smoking is the oldest and most common method of fish preservation in many developing countries (Krasemann 2004; Kumolu-Johnson *et al*., 2010). It is a method of preservation effected by combination of drying and decomposition of naturally produced chemical resulting

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from thermal breakdown of wood (Tobor, 2004). The smoke is produced by the process of incomplete combustion of wood in order to impart a characteristic flavour and colour to the fish. Smoke contributes to fish preservation and shelf life by drying, cooking, acting as an effective antioxidant, bacteriostatic and bactericidal agent as well as by depositing natural wood–smoke chemicals like tars, phenols and aldehydes; all of which provide a protective film on the surface of smoked fish and have powerful bactericidal action and prevent the growth of other microorganisms on the flesh of the fish (Gilbert and Knowles, 1995; Horner, 1997; Doe, 1998; Rorvik, 2000; Garrow and James, 2000; Daramola *et al*., 2007; Ahmed *et al*., 2010; Daramola *et al*., 2013). Several methods are available for fish smoking and different smoked products have been developed in various parts of the world in relation to the properties of the locally available raw materials and the general level of technology (Olley *et al.,* 1988).

African catfish (Clarias gariepinus) is one of the most important fish species currently being cultured both inside and outside its natural range of tropical and subtropical environments (Adewolu *et al*., 2008). Positive attributes such as resistance to diseases, high fecundity, and ease of larval production in captivity make it of commercial importance in aquaculture (Haylor, 1991). It is of great importance as it grows quickly, attains a large size, and is an edible fish with few spines in its flesh. It can withstand wide range of environmental conditions, including severe temperatures, as well as low oxygen. The importance of catfish itself cannot be overemphasized. According to Anoop et al., (2009), it provides food for the populace, it allows for improved protein nutrition because it has a high biological value in terms of high protein retention in the body, higher protein assimilation as compared to other protein sources, low cholesterol content and one of the safest sources of animal protein.

The aim of this study is to evaluate the nutritional value of the smoked *Clarias gariepinus* sold at the major markets in Southwest, Nigeria.

II. Materials and Methods

a) Sample collection

The fish samples used for this study were purchased from four major markets in Oyo and Ekiti States in Southwest, Nigeria. Two major markets (A and B) were selected in Ibadan, the capital of Oyo State and two major markets (C and D) in Ado-Ekiti, the capital of Ekiti State. These markets were selected because they are markets generally patronized by the populace. All samples were transported to the Department of Biological Sciences, Afe Babalola University for analyses.

b) Analysis of samples

The proximate analyses of the all the samples from the various markets (A, B, C and D) for moisture, ash and carbohydrate contents were determined as described by AOAC (2005). Crude protein, fibre and fat contents were determined using the methods described by Pearson (1976). Mineral contents of all the samples were determined by atomic absorption spectrometry, flame photometry and spectrophotometry according to the methods of AOAC (2003). The phytochemical analysis for the presence of saponins, tannins, alkaloids, and cyanogenic glycosides in the samples were carried out according to the methods described by Harborne (1973) and Trease and Evans (1983). The vitamins in the samples from the four markets were determined by the official methods of the Association of official Analytical chemists (AOAC, 1990). Each analysis was carried out in triplicate.

c) Statistical analysis

All assays were carried out in triplicate, and the means and standard error of means (SEM) were determined using SPSS version 20. Analysis of variance was performed to determine significant differences between the paired samples. Differences in paired samples performance for each nutrient and chemical composition were tested by the Student's t-test. <0.05 implies significance.

III. Results

The proximate analyses of the samples from the different markets are shown in Table 1 while Table 2 shows the paired samples test of the proximate analyses of the samples from the markets. The values of the proximate analyses in the samples varied from market to market. The moisture content, protein, fat, fibre, ash and carbohydrate contents from the markets were in the range of 9.63 to 10.27%, 53.77 to 54.77%, 11.77 to 13.13%, 6.87 to 8.00%, 0.0 to 0.07% and 15.40 to 16.17% respectively. Samples from Market A and Market D recorded higher values of moisture contents than samples from Markets B and C. Table 2 shows that there were significant differences in the moisture content values between the samples from Market A and Markets B, C and between samples from Market D and Markets B, C. There was no significant difference in moisture values between samples from Market A and D and between samples from Market B and C. The protein content values of the samples from the markets were high but showed variation in the markets. There was a significant difference in the protein values of the samples between Market A and Market B and between Market B and Market C. The fat content showed significant difference only between samples from Market C and Market D. There was no significant different in the crude fibre and carbohydrates values of the samples from the markets.

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Table 1 : Proximate Analyses of *Clarias gariepinus* from the four markets

Parameters	Market A	Market B	Market C	Market D
Moisture content (%)	10.13±0.09	9.63±0.09	9.67±0.09	10.27±0.09
Protein (%)	54.53±0.09	53.77±0.07	54.77±0.09	54.17±0.09
Ether extracts (fat) %	12.17±0.09	12.33±0.09	13.13±0.09	11.77±0.07
Ash (%)	7.63±0.09	8.00±0.07	6.87±0.09	7.53±0.09
Crude fibre (%)	0.07±0.03	0.00	0.00	0.03±0.03
Carbohydrate (by difference) %	15.43±0.09	16.17±0.12	15.40±0.17	16.03±0.15

Values are means ±SEM (Standard error of means) of triplicate samples.

Table 2 : Paired samples test of proximate analyses of *Clarias gariepinus* from the markets

Parameters	Paired samples	Diff.Mean	Sig. (2-Tailed)
Moisture content (%)	Market A-Market B	0.50±0.12	0.049
	Market A-Market C	0.47±0.09	0.034
	Market A-Market D	-0.13±0.03	0.057
	Market B-Market C	-0.03±0.17	0.860
	Market B-Market D	-0.63±0.09	0.019
	Market C-Market D	-0.60±0.12	0.035
Protein (%)	Market A-Market B	0.77±0.12	0.024
	Market A-Market C	-0.23±0.09	0.118
	Market A-Market D	0.37±0.09	0.053
	Market B-Market C	1.00±0.05	0.030
	Market B-Market D	-0.40±0.15	0.120
	Market C-Market D	0.60±0.15	0.590
Ether extract (fat) %	Market A-Market B	-0.17±0.09	0.200
	Market A-Market C	-0.97±0.09	0.080
	Market A-Market D	0.40±0.17	0.148
	Market B-Market C	-0.80±0.15	0.350
	Market B-Market D	0.57±0.13	0.051
	Market C-Market D	1.37±0.17	0.015
Ash content (%)	Market A-Market B	-0.37±0.13	0.111
	Market A-Market C	0.77±0.18	0.049
	Market A-Market D	0.10±0.15	0.580
	Market B-Market C	1.13±0.07	0.003
	Market B-Market D	0.47±0.03	0.005
	Market C-Market D	-0.67±0.09	0.017
Crude fibre (%)	Market A-Market B	0.07±0.03	0.184
	Market A-Market C	0.07±0.03	0.184
	Market A-Market D	0.03±0.03	0.423
	Market B-Market C	.....	.....
	Market B-Market D	-0.03±0.03	0.423
	Market C-Market D	-0.03±0.03	0.423
Carbohydrate (by difference) %	Market A-Market B	-0.73±0.07	0.008
	Market A-Market C	0.03±0.17	0.860
	Market A-Market D	-0.60±0.23	0.122
	Market B-Market C	0.77±0.23	0.081
	Market B-Market D	0.13±0.24	0.635
	Market C-Market D	-0.63±0.28	0.156

Significant difference ($P < 0.05$)

Table 3 shows the values of mineral compositions of the samples from the markets while Table 4 shows the paired samples test of the mineral compositions of the samples from the markets.

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Table 3 : Mineral compositions of *Clarias gariepinus* from the four markets

Parameters (mg/100g)	Market A	Market B	Market C	Market D
Iron (Fe^{++})	11.33±0.09	10.13±0.09	12.17±0.09	11.57±0.09
Zinc (Zn^{++})	0.43±0,03	0.40±0.06	0.50±0.06	0.33±0.03
Magnesium (Mg^{++})	46.67±1.67	36.67±1.67	28.33±1.67	40.00±2.89
Calcium (Ca^{++})	353.33±6.01	373.33±7.26	358.33±4.41	388.33±1.67
Potassium (K^{+})	33.33±1.67	30.00±2.89	25.00±2.89	22.33±1.45
Phosphorus (PO_4^{---})	280.01±2.89	288.33±4.41	271.67±4.41	305.00±2.89
Ca/P	1.26±0.02	1.30±0.01	1.32±0.04	1.27±0.02
Ca/Mg	7.60±0.36	10.22±0.47	12.75±0.84	9.81±0.67
Ca/K	10.65±0.53	12.71±1.36	14.67±1.76	17.54±1.19

Values are means ±SEM (Standard error of means) of triplicate samples.

Table 4 : Paired samples test of the mineral composition of *Clarias gariepinus* from the markets

Parameters	Paired samples	Diff. Mean	Sig. (2-Tailed)
Iron	Market A-Market B	1.20±0.15	0.016
	Market A-Market C	-0.83±0.18	0.042
	Market A-Market D	-0.23±0.17	0.300
	Market B-Market C	2.03±0.09	0.002
	Market B-Market D	1.43±0.03	0.001
	Market C-Market D	0.60±0.06	0.09
Zinc	Market A-Market B	0.03±0.07	0.667
	Market A-Market C	-0.07±0.03	0.184
	Market A-Market D	----------	--------
	Market B-Market C	-0.10±0.01	0.423
	Market B-Market D	0.07±0.07	0.423
	Market C-Market D	0.17±0.03	0.038
Magnesium	Market A-Market B	10.00±2.89	0.074
	Market A-Market C	18.33±1.67	0.008
	Market A-Market D	6.67±4.41	0.270
	Market B-Market C	8.33±3.33	0.130
	Market B-Market D	-3.33±1.67	0.184
	Market C-Market D	11.67±4.41	0.118
Calcium	Market A-Market B	20.00±2.89	0.020
	Market A-Market C	5.00±2.89	0.225
	Market A-Market D	35.00±5.00	0.020
	Market B-Market C	15.00±2.89	0.035
	Market B-Market D	15.00±5.77	0.122
	Market C-Market D	30.00±2.89	0.009
Potassium	Market A-Market B	3.33±1.69	0.184
	Market A-Market C	8.33±4.41	0.199
	Market A-Market D	11.00±2.08	0.034
	Market B-Market C	5.00±5.00	0.423
	Market B-Market D	7.67±2.33	0.081
	Market C-Market D	2.67±2.67	0.423
Phosphorus	Market A-Market B	8.33±4.41	0.199
	Market A-Market C	8.33±6.00	0.300
	Market A-Market D	25.00±5.00	0.038
	Market B-Market C	16.67±8.82	0.199
	Market B-Market D	16.67±7.26	0.149
	Market C-Market D	33.33±1.67	0.02
Ca/P	Market A-Market B	-0.04±0.01	0.093
	Market A-Market C	-0.06±0.02	0.122
	Market A-Market D	-0.01±0.00	0.057

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	Market B-Market C	-0.02±0.03	0.551
	Market B-Market D	0.02±0.01	0.222
	Market C-Market D	0.05±0.02	0.148
Ca/Mg	Market A-Market B	-2.63±0.53	0.039
	Market A-Market C	-5.15±0.76	0.021
	Market A-Market D	-2.21±0.97	0.150
	Market B-Market C	-2.52±1.25	0.181
	Market B-Market D	0.42±0.58	0.550
	Market C-Market D	2.94±1.48	0.186
Ca/K	Market A-Market B	-2.05±0.85	0.138
	Market A-Market C	-4.01±2.09	0.195
	Market A-Market D	-6.89±1.10	0.025
	Market B-Market C	-1.96±2.52	0.517
	Market B-Market D	-4.84±1.15	0.052
	Market C-Market D	-2.88±1.43	0.181

Significant difference (P<0.05)

The values of the mineral composition in the samples varied from market to market. The range was 10.13 to 12.17mg/100g, 0.33 to 0.50mg/100g, 28.33 to 46.67mg/100g, 353.33 to 388.33mg/100g, 22.33 to 33.33mg/100g, and 271.67 to 305.00mg/100g for iron, zinc, magnesium, calcium, potassium and phosphorus respectively. There was a significant difference in iron content of the samples between Market A and Markets B, C and between Market B and Markets C, D. There was a significant difference in the values of zinc in the samples between Market C and Market D. Magnesium in the samples showed significant difference between Market A and Market C. There was a significant difference in the values of calcium in the samples between Market A and Markets B, D; between Market B and Market C and between Market C and Market D. Potassium showed significant difference in the samples between Market A and Market D while Phosphorus showed significant difference in the samples between Market A and D and between Market C and Market D.

Table 5 shows phytochemical and vitamin compositions of the samples from the markets while Table 6 shows the paired samples test of the phytochemical and vitamin compositions of the samples from the markets. The phytate, saponin, ascorbic acid, thiamine, niacin and riboflavin contents were in the range of 21.67 to 28.33mg/100g, 0.00 to 0.17mg/100g, 0.17 to 0.27mg/100g, 0.05 to 0.07mg/100g, 0.24 to 0.28mg/100g, and 0.05 to 0.08mg/100g respectively. Thiamine and phytates showed no significant difference in their values in the samples between the markets while ascorbic acid and riboflavin showed significant difference in their values in the samples only between Market C and Market D. Niacin showed significant difference in its values in the sample between Market A and Market B and between Market B and Market C while saponin showed significant difference in its value in the samples between A and Market C and between Market C and Market D.

Table 5 : Phytochemical and vitamin compositions of *Clarias gariepinus* from the markets

Parameters	Market A	Market B	Market C	Market D
Pyhtates	28.33±1.67	21.67±1.67	25.00±2.89	28.33±1.67
Saponins	0.17±0.03	0.17±0.09	0.00±0.00	0.17±0.03
Ascorbic acid	0.27±0.03	0.20±0.06	0.17±0.06	0.33±0.06
TThiamine	0.06±0.00	0.06±0.03	0.07±0.01	0.05±0.01
Niacin	0.24±0.01	0.27±0.01	0.23±0.01	0.28±0.01
Riboflavin	0.07±0.00	0.06±0.00	0.05±0.01	0.08±0.00

Values are means ±SEM (Standard error of means) of triplicate samples.

Table 6 : Paired samples test of the phytochemical and vitamin of *Clarias gariepinus* from the markets

Parameters	Paired samples	Diff. Mean	Sig. (2-Tailed)
Phytates	Market A-Market B	6.67±1.67	0.057
	Market A-Market C	3.33±1.67	0.184
	Market A-Market D	0.00±2.89	1.000
	Market B-Market C	-3.33±3.33	0.423
	Market B-Market D	-6.67±3.33	0.184

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	Market C-Market D	3.33±3.33	0.423
Saponins	Market A-Market B	0.00±0.12	1.000
	Market A-Market C	0.17±0.03	0.038
	Market A-Market D	0.00±0.06	1.000
	Market B-Market C	0.17±0.09	0.199
	Market B-Market D	0.00±0.06	1.000
	Market C-Market D	-0.17±0.03	0.038
Ascorbic acid	Market A-Market B	0.07±0.07	0.423
	Market A-Market C	----------	-------
	Market A-Market D	-0.07±0.03	0.184
	Market B-Market C	0.03±0.07	0.667
	Market B-Market D	-0.13±0.09	0.270
	Market C-Market D	-0.02±0.03	0.038
Thiamine	Market A-Market B	-0.00±0.00	0.423
	Market A-Market C	0.01±0.01	0.529
	Market A-Market D	0.01±0.00	0.184
	Market B-Market C	-0.00±0.01	0.667
	Market B-Market D	----------	-------
	Market C-Market D	0.01±0.01	0.184
Niacin	Market A-Market B	-0.03±0.01	0.035
	Market A-Market C	0.01±0.01	0.383
	Market A-Market D	-0.04±0.02	0.120
	Market B-Market C	0.04±0.01	0.023
	Market B-Market D	-0.01±0.02	0.580
	Market C-Market D	-0.05±0.01	0.067
Riboflavin	Market A-Market B	----------	-------
	Market A-Market C	0.02±0.01	0.199
	Market A-Market D	-0.02±0.00	0.038
	Market B-Market C	0.01±0.01	0.529
	Market B-Market D	-0.03±0.00	0.015
	Market C-Market D	-0.03±0.06	0.038

Significant difference (P<0.05)

IV. Discussion

The moisture content can be used as a pointer to the rate at which deterioration occurs in fish samples resulting in the early decomposition. The moisture content recorded in the samples in the Markets A-D is within the range (9-13%) recorded by Plahar *et* al. (1996) and is considered to be low enough to present little deterioration problems if storage conditions are properly controlled. The low moisture content is to reduce to minimum the conditions in the fish that allow for spoilage organisms and chemical activities. Kaneko (1976) reported that a lot of proteolytic, lipolytic deterioration and microbial proliferation are encouraged at moisture levels of 15% and above. The results of the proximate compositions in this study were slightly different from those of Adebowale *et al.* (2008) who reported the range of moisture, protein, fat and ash content of Nigerian smoked catfish to be 7.16-10.71, 33.66-66.04, 1.58-6.09 and 9.21-12.16%, respectively. The low crude fibre value recorded in the samples from the markets is due to the fact that the energy content in smoked *Clarias gariepinus* is high because crude fiber is considered as indigestible. The crude fibre content indicates the amount of cell walls in the feed. The fat levels in the samples from the four markets were below the range (15-33%) reported by Plahar *et al*. (1991) to cause rancidity problems in storage. In this study, the crude protein formed the largest quantity of the dry matter in all the fish samples. This is in-line with the report that protein forms the largest quantity of dry matter in fish (Pannevis, 1993) and thus, smoked *Clarias gariepinus* is a good source of pure protein and would be more than enough to prevent malnutrition in children and adult who feed solely on this fish as a main source of protein. It also clear from the results of this study that smoked *Clarias gariepinus* is a good source of macro and micro mineral elements in spite of the processing effects of smoking and may contribute to health, growth and development of human beings. The ratios of the mineral compositions further point out the nutritional values of the fish as reported by Watts (2010) that determining nutritional interrelationships is much more important than knowing mineral level alone. Mineral ratios are often more important in determining nutritional deficiencies and excess; it is predictive of future metabolic dysfunctions or hidden metabolic dysfunction. The high Ca/P ratio observed in all the samples from the markets is of nutritional benefit, particularly for children and the aged who need higher intakes of calcium and phosphorus for bone formation and maintenance. Food is considered 'good' if the ratio is above one and 'poor' if the ratio is less than 0.5 while Ca/P ratio above two helps to increase the absorption of calcium in the small

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intestine (Niemann *etal*., 1992). Ca/K ratio is usually called thyroid ratio because calcium and potassium play a vital role in regulating thyroid activity and the ratio in this study is around the range (8-16) needed to maintain the regulation of thyroid activity in good balance (ARL, 2012). Ca/Mg ratio in the fish from the markets is within the range that enhances mental and emotional stability whereas ratio beyond 16 or less than 2 is associated with mental and emotional disturbances (ARL, 2012). The relatively small amount of zinc content recorded in smoked fish from all the markets is not surprising since zinc is a trace mineral and is needed only in small amounts by our bodies but has many important functions. It is needed for the body's defensive (immune) system to properly work; plays a role in cell division, cell growth, wound healing and the breakdown of carbohydrates and is also needed for the senses of smell and taste. The presence of riboflavin, niacin, thiamine and ascorbic acid in all the samples from the markets is a pointer to the nutritional value of smoked *Clarias gariepinus*. Riboflavin is important for body growth and the production of red blood cells; niacin helps maintain healthy skin and nerves and ensures that the digestive and nervous systems function properly; thiamine helps the body cells to change carbohydrates into energy and ascorbic acid helps the body to make collagen, an important protein used to make skin, cartilage, tendons, ligaments, and blood vessels and is also needed for healing wounds, and for repairing and maintaining bones and teeth. The high value of phytates recorded in all the samples from the markets indicates that fishes are likely sources of phytates to their environments. This is because ruminant animals (e.g., cattle, sheep, goats, buffalo) possess phytase producing flora for digesting phytates while non-ruminant animals (e.g., pigs, chickens, dogs, cats, fish) don't have phytase producing flora and as a consequence of low digestibility of phytates by fish, most of the phytates end up being excreted and make their way into their immediate environments. The relative small quantity of saponins in all the samples from the markets is likely to be due to their toxicity to cold-blooded animals at certain concentration. Francis *et al* (2002) reported that saponins are toxic to fish.

However, there were variations in values of the proximate analyses and the chemical compositions of *Clarias* gariepinus from the markets sampled and these variations are likely to affect the wholeness, safety and shelf life of the products. Variations in proximate and chemical compositions of smoked fish are said to be caused by different factors, such as fish species, smoking methods, smoking time and salt concentration (Adegunwa *et al*., 2013). Huda *et al* (2010) reported that nutrient content of fish is influenced by several factors including smoking method and time and the nutrient composition of locally available foods. According to Swastawati (2004) differences in smoked fish flesh composition are due to different fish species and smoking methods and Dvorak and Vognsrova (1997) reported that difference in smoke quality can make the end-products to differ with respect to nutritional esthetic quality. This is because, according to Kostrya and Pikielna (2006), different smoke sources produce different complex smoke compounds that could consist of mixture of various volatile and non volatile compounds, such as phenol, syringol and guaiacol and its derivatives that affect the quality of the smoked fish. In this study, the variations observed in proximate and chemical compositions of the samples from the different markets may be due to smoking methods and time and not because of difference in species. This is because traditional fish smoking devices are poorly constructed; the technology employed by local fishermen in smoking is not standardized and lack mechanisms for the control of smoke and heat production so that most parameters remain uncontrolled. Hence, essential drying parameters such as duration, air humidity and temperature which affect the efficiency of smoking and the quality of the final products (Olopade *et al*., 2013) are not precisely determined and mastered. In addition, the variations in the nutritional value of *Clarias gariepinus* from different markets may also be due to the storage methods and the durations of storage after smoking. Smoking decreases the water activity in fish tissue (Sveinsdottir, 1998) and if the smoked fish is not properly stored afterward, the efforts involved in smoking may not yield the expected preservative effect. Jallow (1995) reported that fish with 10-15% moisture content has a shelf life of 3-9 months when stored properly. Thus the concentrations of chemicals in smoked fish are contingent on the storage time and temperature. It is therefore necessary to consider the recommendations of Daramola *et al*. (2007) that "intermittent sun-drying or mild smoking can be carried out on smoked fish to extend its shelf life; moisture content less than 10% should be maintained in stored smoked fish to reduce the growth of bacteria and moulds and preservatives such as pirimiphos-methyl (actelic) can be applied to preserve smoked fish." Thus, this study advocates the need for the adoption of good processing practices and storage methods of smoked fish. In addition, the people that are involved in the processing and selling of smoked fish should maintain hygienic environment and practices so as to ensure that safety standards are maintained in smoked fish and market worthiness of the products is preserved.

V. Conclusion

The nutritional and chemical compositions of smoked *Clarias gariepinus* showed variations from market to market; the results however indicate that smoking method is an important preservation method which could preserve the nutritive values of fishes and

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possibly reduce post-harvest losses. However, good smoking method should be adopted and hygienic and proper storage devices put in place.

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Description of Sheep Production System, Husbandry Practices and Assessment of Major Constraint in Dawuro Zone and Konta Special Wereda of South Region of Ethiopia

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Abstract- The study was conducted to describe sheep husbandry practices and production system and to assess major constraint in Dawuro zone and Konta special woreda of South Nations Nationalities and Peoples Regional State of Ethiopia. A total of 180 households were selected purposively for characterization of the production system. Sampling frame was established in a multistage clustered sampling procedure in compliance with the main indigenous sheep types of the study area. A structured questionnaire, group discussion and secondary sources were used to gather data on sheep production system and husbandry practices. The result showed that most of the households heads are males (83.3%-96.7%) and mixed crop-livestock system are the dominant production system. Among the livestock species, sheep accounted for the largest proportion (35.9%-50.2%) in the study area, and the average sheep flock size ranged from 9.72 in Mareka to 11.35 in Tocha.

Keywords: description, production system, husbandry practices, constraint, dawuro, konta.

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Description of Sheep Production System, Husbandry Practices and Assessment of Major Constraint in Dawuro Zone and Konta Special Wereda of South Region of Ethiopia

Amelaml Alemayehu [α], Yoseph Mekasha [σ], Solomon Abegaz [ρ] & Adisu Jimma [ω]

Abstract- The study was conducted to describe sheep husbandry practices and production system and to assess major constraint in Dawuro zone and Konta special woreda of South Nations Nationalities and Peoples Regional State of Ethiopia. A total of 180 households were selected purposively for characterization of the production system. Sampling frame was established in a multistage clustered sampling procedure in compliance with the main indigenous sheep types of the study area. A structured questionnaire, group discussion and secondary sources were used to gather data on sheep production system and husbandry practices. The result showed that most of the households heads are males (83.3%-96.7%) and mixed crop-livestock system are the dominant production system. Among the livestock species, sheep accounted for the largest proportion (35.9%-50.2%) in the study area, and the average sheep flock size ranged from 9.72 in Mareka to 11.35 in Tocha. Breeding ewes accounted for the largest proportion in Tocha (20%) and Konta (20.2%) Woreda, but it was next to ram lambs and castrates in Mareka (15.3%). The major purpose of keeping male sheep across all the woreda was primarily for to be used as an asset (saving), with an index ranging from 0.18 to 0.30, followed by income generation, with an index ranging from 0.18-0.25. The purpose of keeping male sheep for breeding is moderate. Farmers in Tocha and Konta keep female sheep primarily for breeding (index=0.32-0.48), but for income generation in case of Mareka (index=0.32).Natural pasture and crop residue were the main feed sources and rivers and spring water were main water source for sheep in the study areas. Feed shortage and disease are the major production constraints in all the studied woreda. From the sampled farmers, majority of them (90-96.7%) practiced docking.

Keywords: description, production system, husbandry practices, constraint, dawuro, konta.

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I. Introduction

In the country the production system and marketing are almost traditional (Legesse et al., 2008) but in this circumstance sheep are used to generate income that is used to purchase cloths, food items, breeding stock, oxen, fertilizer, household supplies and also to pay taxes (Chipman, 2003). Developing countries like Ethiopia, where subsistence agriculture is common, and farmers keep small ruminants for trade and meat consumption in household where gross income is determined by the size of the flock number raised by the owners (Gemeda *et al.*, 2007).

Even if the productivity of indigenous sheep breed is clearly low due to a number of limitations like genotype, feed, disease, institutional, environmental and infrastructural constraints (Niftalem, 1990; Abebe, 1999; Markos, 2006) the sheep types have the ability to add value in subsistence way of living of the low input smallholder and pastoral production systems(Kosgey and Okeyo, 2007). So, this study was carried out to describe sheep population and the production system in the Dawuro (Tocha and Mareka) zone and Konta special woreda is the base stone for any breed or/and production improvement pans. in general the objective of this study was to describe sheep husbandry practices, production system and to assess major constraint of the study area.

II. Materials and Methods

a) Description of the Study Areas

i Dawuro Zone

Dawuro zone is one of the 13 zones of Southern Nations Nationalities and Peoples Regional state (SNNPR) and geographically located in south western part of the country. Dawuro zone is bordered by Hadiya zone in the North, Kemebata-Tembaro zone in North east, Wolayita zone in the East, Gamo-Gofa zone in the west and Konta special woreda and Jimma (Oromiya) zone in the west (Terefe Degefa *et al.*, 2003). Dawuro zone is delineated by Omo River in north and south and Gojeb River in North-west (Anonymous, 2004). Dawuro

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is situated at an altitude ranging from 730 to 2850 m.a.s.l., longitude 37°09'E and latitude 7°08 'N. The capital of Dawuro zone is Tercha, which is located at about 507 km from Addis Ababa and 282 km from Hawassa (the capital city of SNNPR). The annual mean maximum and minimum temperature of the zone is 26.4°C and 14.9°C, respectively (Agricultural office of the zone). The annual mean rainfall of the zone ranged from 1200 to 1800 mm (BoPED, 1998). The main rainy season of the zone is between June to September (long rainy season), short rainy season from March to April, and dry season lasts from October to February and May (Agricultural office of the zone). Dawuro zone has five woredas and 37 *kebeles* or Peasant Associations (PA). Agro- ecologically Dawuro consist of highland (*Dega*; 20.9%), mid-highland (*Woinadega*; 41%) and lowland (*Kolla*; 37%). The land use pattern is composed of 30 % annual crops , 25% of perennial crops, 10 % of grazing land, 40 % covered with forest land and agro - forestry. Topographically the district consists of plain (10%), mountain (85%) and plateau (5%). Totally Dawuro zone covers about 446,082 hectare of land.

From the natural vegetation perspective, Dawuro zone predominantly known for growing bamboo. Bamboo has a vital and critical role in each and every living process of Dawuro people. Most of the houses and fences are made of bamboo and the known cultural food in the area known as "*Kocho*", which is made of the Enset crop (*Enset verticosum*), is also processed with the material made of bamboo.

According to Central Statistical Agency (CSA, 2008), Dawuro has an estimated total human population of about 492,000. The study zone has also a total of 332,490 cattle, 106,163 sheep, 51,755 goats, 6,724 horses, 2,655 donkeys, 5,237 mule, 171,716 poultry and 9,483 beehives (South Agriculture and Rural Development Office).

ii *Konta special woreda*

The other area where the study was conducted was Konta special woreda of Southern Nations, Nationalities and Peoples Regional state (SNNPR). Konta special woreda is situated at an altitude of 900-2300 m.a.s.l. at a distance of 330 & 460 km of Hawassa & Addis Ababa respectively. The average maximum and minimum annual temperature of the woreda is 37°C and 21°C, respectively. The main rainy season lies in between June to September (long rainy season), short rainy season from March to April, and the dry season lasts from October to February and May (Agricultural office of Konta special woreda).

Agro- ecologically, Konta special woreda consists of highland (*Dega*; 6%), mid-highland (*Woinadega*; 54%) and lowland (*kola*; 40 %). About 30% of the Konta special woreda land is covered with annual crops, 25% covered with perennial crops, 5% covered with grazing land, 15% covered with forest and bush land and 10% agro forestry. Topographically the district consists of plain 15%, mountain 80% and plateau 5 %. (Agricultural Office of Konta Special woreda). Konta special woreda has 71,212 heads of cattle, 16,457 heads of sheep, 11,873 heads of goat, 1,137 heads of horse, 510 heads of mule, 77,226 poultry and 20,263 beehives (South Agriculture and Rural Development Office).

b) Sampling Technique

Sampling frame was established in a multistage clustered sampling procedure in compliance with the main indigenous sheep types of the study area. A rapid reconnaissance survey was made prior to the actual survey work in order to locate the distribution of sheep and their production system in the study area. Dawuro Zone has five woreda, of which 3 woreda were selected strategically based on agro-ecology and sheep population distribution.

From each selected woreda of Dawuro zone and Konta Special Woreda, 3 peasant associations (PA; sampling sites) were selected based on the distribution of sheep population, agro-ecology and accessibility. About 20 households were randomly sampled from each Peasant association based on the distribution of sheep through discussion with key informants in the village and secondary information. The number of households which were included in the study was 120 from six PA's of Dawuro zone and 60 from three PA's of Konta special woreda. In total, 180 households were selected for survey. Secondary information on the distribution, number and types of sheep across the different woreda was obtained from agricultural offices of the respective zone and district before starting the actual field work. Geographical location of the study areas are indicated in Figure 1.

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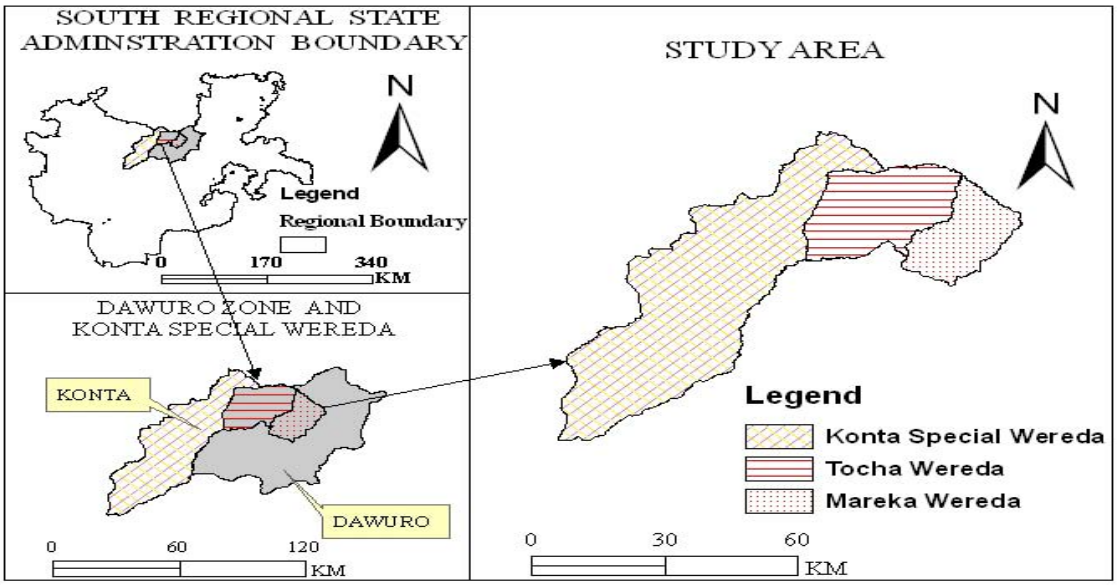

Figure 1 : Map of the study areas

c) Data Collection Procedure

A structured questionnaire, group discussion and secondary sources were used to gather data on sheep production system and husbandry practices.

d) Questionnaire and group discussion

Structured questionnaires were prepared, translated in to local language and administered to collect information on the existing socio-economic characters (sex, age, education level, household size, livestock possession, economic benefit of sheep and major production constraints), reproductive performances (age at first lambing , lambing interval, litter size and lambing pattern), flock structure, breeding management, selection criteria, culling age , castration practices, docking practices, feeds and feeding management, water source and watering , major diseases of sheep in the area, sheep production system and husbandry practices from each selected flock owners and key informants via interview.

Organized group discussion were held with clan or village leaders, Woreda agricultural experts(extension agents), sheep owners and elderly female and male member of the society who are known to have better knowledge on the present and past social and economic status of the area. Discussions were focused on the origin and history of the sheep population, special characteristics of the sheep in the area, chain of sheep market and exchange of sheep with neighbor zones and woreda, current status and major constraints of sheep, production system, and social bylaws on communal interest like communal gazing land, watering point and utilization of ram for breeding. Discussions were held using a prepared check list. Information on the description of the sheep population was recorded from direct counting of qualitative characters and measurements of quantitative characters from all members of the sampled sheep.

e) Data Management and Statistical Data Analysis

The collected data from each study site were checked for any error and corrected during the study period, coded and entered into computer for further analysis.

f) Questionnaire data

Data collected through questionnaire (survey) were entered into Statistical Package for Social Sciences (SPSS 16.0 for windows, release 16.0, 2007). An index was calculated to provide overall ranking for qualitative data such as constraints of sheep production, purpose of keeping sheep, function of male and female sheep and supplementary feeds according to the following formula: Index = Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] given for particular qualitative variables divided by Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables considered.

The rate of inbreeding from effective population size for a randomly mated population was calculated as Ne = (4Nm Nf) / (Nm + Nf); Where Ne = effective population size, Nm = number of breeding males and Nf = number of breeding females. The rate of inbreeding coefficient (F) was calculated from Ne as ΔF = 1/2Ne (Falconer and Mackay, 1996).

III. Results and Discussion

a) General Household Information

A total of one hundred eighty households (60 from each district and 20 from each Peasant Association [PA]) were considered for the household survey in the current study. The result of demographic and socio-economic characteristics of the households is presented in Table 1.

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Table 1 : Sex, education background and age structure of the household

Household	Dawuro Zone				Konta Special Woreda	
	Tocha Woreda		Mareka Woreda			
	N	%	N	%	N	%
Sex						
• Male	58	96.7	53	88.3	50	83.3
• Female	2	3.3	7	11.7	10	16.7
Education background						
• Illiterate	24	40.0	19	31.7	27	45.0
• Only read &write	9	15.0	22	36.7	10	16.7
• Only 1-8	14	23.3	12	20.0	18	30.0
• Only 9-12	13	21.7	7	11.6	5	8.3
Age						
• <30	12	20.0	15	25.0	26	43.3
• 31-40	16	26.7	25	41.7	21	35.0
• 41-50	13	21.7	16	26.7	10	16.7
• 51-60	12	20.0	4	6.6	3	5.0
• >60	7	11.6	0	0	0	0

In this study male headed household accounted for the largest proportion of the studied samples (respondents) throughout the study areas. Thus, the proportion of male headed household in Tocha, Mareka and Konta special woreda was 96.7%, 88.3% and 83.3%, respectively. Interviewed households in the study area have different educational backgrounds. The largest proportion of household heads in Tocha (40%) and Konta Special woreda (45%) were illiterate; whereas the largest proportion in Mareka woreda (36.7%) were only able to read and write. The proportion of household heads in grade 9-12 were 21.7% in Tocha; whereas the proportion for Mareka and Konta special woreda was 11.6% and 8.3%, respectively.

b) Farming Activities

In all the studied districts, farmers practice crop and livestock production. Both livestock and crop has vital role in each and every living process of the farmers (Table 2). In Dawuro zone (Tocha and Mareka) and konta special woreda farmers mainly grow barley, wheat, teff, sorghum, maize, been, pea, taro and enset (kocho).

Table 2 : Importance or use of major farming activities in the study area

Importance	Dawuro Zone				Konta Special Woreda	
	Tocha		Mareka			
	N	%	N	%	N	%
For food consumption						
• Crop production	60	100	60	100	57	95
• Livestock production	0	0	0	0	3	5
For Income						
• Crop production	7	11.9	6	10	25	41.7
• Livestock production	1	1.7	0	0	22	36.7
• Both	51	86.4	54	90	13	21.7

N = number of observation, %=Percentage of respondent (hose hold)

c) Livestock species composition in the study areas

The average livestock possessions in the study areas are presented in Table 3. The largest average number of livestock possessed by the three woreda was sheep, chicken, followed by cattle. Because of the fact that this study involved farmers who owned sheep, as a major criterion, all respondent (100%) across the study area had sheep. However, the proportion of farmers who owned cattle was 16.61%, 21.38% and 16.97% in Tocha, Mareka and Konta special woreda, respectively. The average holding of sheep at Tocha, Mareka and Konta, which was 11.35 ±2.33, 9.72±1.04 and 10.75±2.88, respectively, was lower than the average holding reported for Gumuz sheep (16.02 ± 14.1), comparable to 11.3 ± 1.27 reported for Adiyo Kaka sheep, but higher than 8.2 ± 2.05 reported for Horro

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sheep (Solomon, 2007; Zewdu, 2008). The average number of pack animals (horses, mules and donkeys), however, was the lowest in the studied areas, except in Konta woreda where the proportion of horse and donkey is higher than that of goat.

Table 3 : Average (±SD) livestock species composition in Dawuro Zone and Konta Special Woreda

Location and livestock		N	Mean flock size	%	SD	Minimum	Maximum
Tocha							
	Cattle	57	3.75	16.61	1.43	1	6
	Sheep	60	11.35	50.27	2.33	5	15
	Chicken	58	4.28	18.95	2.11	1	10
	Donkey	5	1.2	5.31	0.45	1	2
	Mule	7	1.0	4.43	0	1	1
	Horse	17	1.0	4.43	0	1	1
Mareka							
	Cattle	59	5.05	21.38	1.29	2	8
	Sheep	60	9.72	41.15	1.04	6	13
	Chicken	60	5.38	22.78	2.06	2	11
	Donkey	16	1.38	5.84	0.5	1	2
	Mule	8	1.0	4.23	0	1	1
	Horse	11	1.09	4.61	0.3	1	2
Konta							
	Cattle	55	5.07	16.97	2.49	1	11
	Sheep	60	10.75	35.98	2.88	4	16
	Goat	6	1.67	5.59	1.21	1	4
	Chicken	41	6.22	20.8	3.74	2	20
	Donkey	2	2.5	8.37	2.12	1	4
	Mule	3	1.0	3.35	0	1	1
	Horse	12	2.67	8.94	1.67	1	6

d) Sheep Flock Structure

The overall mean sheep flock size was higher for Tocha Woreda followed by Konta and Mareka (Table 4). In Tocha woreda, breeding ewes accounted for the largest number (2.37±1.31; 20.7%) followed by ram lambs less than 6 months old (1.83±.65; 16%), castrates (1.65±.81), rams [6-12 months old] (1.61±.76) and ewes [6-12 months old] (1.51±.60). In Konta as well, breeding ewes accounted for the largest number (2.18±1.33; 20.2%). However, unlike Tocha, it was followed by castrates (2.0±1.8; 18.6%), ram lambs less than 6 months old (1.73±.65), rams [6-12 months old] (1.41±.65) and ewe lambs less than 6 months old (1.31±.56). In Mareka woreda, the largest number of sheep category in a flock was ram lambs less than 6 months old (1.70±.82; 17.6%) followed by castrates (1.65±.1.11; 17%), breeding ewes (1.48±.83; 15.3%), ewes [6-12 months old] (1.35±.48) and rams [6-12 months old] (1.34±.48). However, the number of breeding rams in a flock was generally small. In fact the proportion of breeding ram and ewe can determine the production of lambs in a flock. The proportion of breeding ewes (15.3-20.7%) obtained in this study was below 30% reported for Keffa and Bench-Maji ewes (Dejen, (2010), 46.8% reported for Menz breeding ewes and 49.2% reported for Afar ewes (Tesfaye (2008). The ratio of breeding ram to ewe was 1:1.98. This ratio is higher than 1:5.21 reported for Keffa and Bench-Maji (Dejen, 2010),, 1:6.7 for Gumuz Solomon (2007), 1:8.3 reported for Menz 1:17.4 reported for Afar sheep (Tesfaye, 2008).

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Table 4 : Average sheep flock structure in surveyed households in the study areas

Sheep flock structure	Tocha			Mareka			Konta		
	N	Mean±SD	%	N	Mean± SD	%	N	Mean± SD	%
Ram lambs [less than 6 months old]	36	1.83±.65	16	31	1.70±.82	17.6	19	1.73±.65	16.0
Rams [6-12 months old]	31	1.61±.76	14.1	35	1.34±.48	13.8	24	1.41±.65	13.1
Breeding ram [older than 1 year]	18	1.05±.23	9.1	12	1.08±.28	11.1	17	1.0±.00	9.3
Castrates	48	1.65±.81	14.4	29	1.65±.1.11	17.0	22	2.0±1.8	18.6
Ewe lambs [less than 6 months old]	29	1.41±.67	12.3	23	1.06±.25	10.9	23	1.31±.56	12.1
Ewes [6-12 months old]	37	1.51±.60	13.2	42	1.35±.48	13.9	33	1.12±.54	10.4
Breeding ewes [older than 1 year]	45	2.37±1.31	20.7	50	1.48±.83	15.3	48	2.18±1.33	20.2

e) Trend in Livestock Population and Land Holding

As indicated in (Table 5). The majority of the farmers in Tocha woreda reported a decreasing trend in cattle population (81.4%), while slightly larger proportion of farmers in Mareka (48.3%) and Konta (49.1%) woreda reported an increasing trend in cattle population. On the other hand, majority of the households studied across all the woreda reported an increasing trend in sheep population (53.7-86.4%). A decreasing pattern of land holding was observed by most of the respondents (91.7 %) in Tocha, while the largest proportion of farmers in Mareka (76.6%) and Konta reported (58.3%) that they observed no change. Nevertheless, still some number of farmers in Mareka (21.7%) and Konta (31. %) woreda admitted a decline in landholding pattern. The increase in human population, lack of expansion of land, over farming of land and land degradation because of erosion are some of the reported factors for declining landholding in the present study.

Table 5 : Trend in Livestock Population and Land holding

Trends	Woreda					
	Tocha		Mareka		Konta	
	N	%	N	%	N	%
Cattle population						
• Increase	11	18.6	29	48.3	27	49.1
• Decrease	48	81.4	27	45.0	22	40.0
• No change	0	0	4	6.9	6	10.9
Sheep population						
• Increase	51	86.4	35	58.3	29	53.7
• Decrease	8	13.6	25	41.7	19	35.2
• No change	0	0	0	0	6	11.1
Land holding Status						
• Decrease	55	91.7	13	21.7	19	31.7
• Increase	5	8.3	1	1.7	6	10.0
• No change	0	0	46	76.6	35	58.3
Reason for decreasing land holding						
• Increase in population	47	85.5	13	52	10	27.0
• Lack of expansion of land	_	_	12	48	23	62.2
• Over farming of land	7	12.7	_	_	1	2.7
• Degradation of land because of flood	1	1.8	_	_	3	8.1

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f) Purpose of Keeping Sheep

i *Purpose of keeping male Sheep*

The purpose of keeping male sheep by farmers in the study areas is presented in Table 6. The primary purpose of keeping male sheep in Tocha woreda was reported to be for saving (to be used as an asset) with an index value of 0.28, followed by income generation [index=0.21]. However, keeping sheep for meat purpose in Tocha stands last [index=0.13].

Table 6 : Purpose of keeping male sheep as ranked by respondents in the study areas

Purpose of keeping male sheep by Woreda	Index
Tocha Woreda	
• For meat	0.13
• As indictor of wealth	0.18
• For breeding	0.18
• As an asset (saving)	0.28
• As income source	0.21
Mareka Woreda	
• For meat	0.21
• As indictor of wealth	0.11
• For breeding	0.11
• As an asset (saving)	0.30
• As income source	0.25
Konta Special Woreda	
• For meat	0.16
• As indictor of wealth	0.11
• For breeding	0.12
• For manure	0.16
• For skin	0.08
• As an asset (saving)	0.18
• As income source	0.18

Index= sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) given for each purpose divided by sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for all purpose of keeping sheep in a production system.

Similar to Tocha, the primary reason for keeping male sheep in Mareka woreda was for saving (to be used as an asset) with an index of 0.30 followed by income generation (index= 0.25), and meat (index= 0.21). However, the primary purpose of keeping male sheep for the Konta farmers was both for saving (as an asset) and income generation with comparable index values of 0.18, followed by manure and meat with the index of 0.16. Unlike Tocha and Mareka, farmers in Konta woreda keep sheep for manure production and skin as well. In general, this study showed that farmers across all the woreda keep sheep for multipurpose. The finding is in agreement with Abebe (1999) who reported that farmers in central highlands of Ethiopia rear sheep for multi-purposes.

ii *Purpose of keeping female Sheep*

The purposes of keeping female sheep by farmers in the study area are presented in Table 7. As breeding is a means to maintain the flock the primary purpose of keeping female sheep in Tocha woreda was for breeding with the index of 0.48 followed by saving (to be used as an asset), income generation and meat with an index of 0.24, 0.14 and 0.13, respectively. For Mareka farmer's the primary purpose of keeping female sheep was to use it as an asset with an index of 0.32, followed by for breeding, income generation and for meat with the index of 0.27, 0.26 and 0.14, respectively. Konta farmers give priority for breeding with an index of 0.32, followed by meat, as an asset and income generation with an index of 0.28, 0.23 and 0.16, respectively. From this study it is apparent that farmers in Tocha and Konta are different from Mareka since the former ranked the primary purpose of keeping female sheep for breeding than the latter. The finding is in contrast with Kosgey (2004) who observed low ranking of small ruminants for breeding purpose among the smallholders and pastoralists in Kenya.

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Table 7 : Purpose of keeping female sheep in the study area as ranked by respondents

Purpose of keeping by Woreda	Index		
	Tocha	Mareka	Konta
• For meat	0.13	0.14	0.28
• For breeding	0.48	0.27	0.32
• As an asset (saving)	0.24	0.32	0.23
• As income source	0.14	0.26	0.16

Index= sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) given for each purpose divided by sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for all purpose of keeping sheep in a production system.

g) Feed source and grazing management

Feed resources commonly used by farmers in the study area across the different seasons are presented in Table 8. The quantity and quality of feed resources available for animals primarily depends upon the climatic and seasonal factors (Zewdu, 2008). In this study, natural pasture (fig. 2), improved forge, hay, crop residue and crop after math are the common feed resources used in the study area. Natural pasture was the major feed source in rainy season across all the studied woreda. However, the major feed resource commonly used in dry season was crop residue as reported by 76, 98 and 85% of the farmers in Tocha, Mareka and Konta Woredas, respectively. Even though the use of hay was moderate in the study area, farmers in Tocha and Konta use hay both in rainy and dry season. The importance of natural pasture as major feed resource for sheep was also reported by Solomon (2007). In general, natural pasture, crop residue, crop after math, hay and improved forge serve as feed sources during both the rainy and dry season in Tocha. In Mareka, however, natural pasture, crop residue and crop aftermath are the main feed sources during rainy season, while during dry season crop residue, natural pasture, crop aftermath and hay are the major feed resources for livestock. The common feed resources in rainy season in Konta include natural pasture, crop residue, and crop after math, improved forge and hay.

Seasonal feed shortage is among the major constraints that limit sheep production in the study area as reported by 98.3%, 100% and 73.3% of the respondents in Tocha, Mareka and Konta Woreda, respectively. Similarly, feed shortage was reported to be a major production constraint in many parts of the country (Abebe, 1999; Samuel, 2005; Tesfay 2008). The Period of critical feed shortage in the study area ranges from June to November. This period covers long rainy season, where most of the arable lands are covered by crops, and short dry season until harvesting the grains. To manage feed shortage farmers provide supplements like local brewery and liquor residues (Tella and Katikalla atella), grains, leaves of inset, grass hay , crop residues.



Figure 2 : Tocha sheep grazing in natural pasture

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The major crop residues used for supplementation by Tocha farmers were wheat (74.1%), barely (79.3%), sorghum (24.1%), maize (74.1%), beans (38.6%) and peas (17.2%). Similarly farmers in Mareka woreda supplement their animals with wheat (68.3%), barely (68.3%), sorghum (68.9%) maize (100%) beans (68.3%) and peas (100%) residue. The proportion for Konta farmers was 25%, 21.7%, 16.7%, 71.1%, 23.3% and 18.3% for wheat, barley, sorghum, maize, been and pea, respectively.

The use of common salt (mineral supplementation) as supplement for sheep was well recognized and practiced by majority of farmers in all study sites. The same practice was reported on Bonga and Horro sheep keepers (Zewdu, 2008).

Table 8 : Feed resources commonly used in the study area by Woreda and season

Type of feed sources	Tocha				Mareka				Konta			
	Rainy season		Dry season		Rainy season		Dry season		Rainy season		Dry season	
	N	%	N	%	N	%	N	%	N	%	N	%
• Natural pasture	60	100	46	78	60	100	40	67	56	93.3	39	65
• Improved forage	8	14	10	16.9	0	0	0	0	17	28.8	13	21.7
• Hay	13	22	14	23.7	0	0	35	58	3	5.3	15	25
• Crop residue	46	78	45	76.3	20	33.3	59	98	39	65	51	85
• Crop after math	39	66	32	54.2	12	20	40	67	26	44.1	18	30

N=Number of respondents; N.B. More than one response was possible

As showed in table 9, during the rainy season majority (64.4%) of sheep owners in Tocha and Konta (58.3%) freely release their sheep for grazing where as in Mareka majority (85 %) of the farmers practice tethering (Fig. 3). However, during the dry season 59.3% and 53 % of Tocha and Konta farmers, respectively, herded their sheep. In Mareka tethering was the most important practice mostly because of it avoids crop damage; protect the stock against theft, ease of protecting from predation and proper utilization of the limited grazing land. Such reasons were reported in the area earlier (Dejen, 2010; Zewdu, 2008; Workneh, 1992).

Table 9 : Grazing method practiced in the study area in different season

Grazing method	Tocha				Mareka				Konta			
	Rainy season		Dry season		Rainy season		Dry season		Rainy season		Dry season	
	N	%	N	%	N	%	N	%	N	%	N	%
Free grazing	38	64.4	26	44.1	19	31.7	59	88	35	58.3	32	53
Herding	30	50.8	35	59.3	39	65	0	0	26	43.3	32	53
Rotational grazing	10	16.9	16	27.1	21	35	5	8.3	11	18.6	13	22
Tethering	22	37.3	0	0	51	85	0	0	23	38.3	27	45

N.B. More than one response was possible

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Figure 3 : Mareka ewe tethered at around homestead

h) Water sources and watering

According to the respondent (Table 10), river was the major water source in dry season across all the study woreda (64% of Tocha farmers; 51.7 % of Mareka farmers and 58 % of konta farmers). Similarly, river was the major water source during rainy season in Tocha (67.9%) and Konta (47%), while in Mareka spring water (48%) was the main water source during rainy season. Solomon (2007) also reported that river was the major water source in Gumuz sheep in north western lowland of Amhara region.

During the dry season, Tocha (62.5 %), Mareka (96.7%), and Konta (60%) farmers allowed their flock to take water as they needed and when they want, where as 37.5%, 3.3% and 35% of the farmers allowed access to water only once per day. On the other hand, during rainy season majority of the farmers in Tocha (92.9 %), Mareka (100 %) and Konta (58.3%) provided water as they needed and when they want.

Table 10 : Water sources and watering in the study area by Woreda and season

Water source	Tocha				Mareka				Konta			
	Dry season		Wet season		Dry season		Wet season		Dry season		Wet season	
	N	%	N	%	N	%	N	%	N	%	N	%
Deep water hole	1	1.8	–	–	–	–	–	–	–	–	–	–
Pond	19	34	10	17.9	7	11.7	7	12	–	–	7	13
River	36	64	38	67.9	31	51.7	24	40	34	58	27	47
Spring water	–	–	8	14.3	22	36.7	29	48	18	31	9	16
Rain water	–	–	–	–	–	–	–	–	–	–	6	11
Tape water	–	–	–	–	–	–	–	–	–	–	2	3.5
Mix of pond, spring and rain water	–	–	–	–	–	–	–	–	7	12	6	11

i) Housing

In the study area, sheep are housed in different ways (Table 11). The majority of the respondent in Tocha (82.1%), Mareka, (66.7%), and Konta (68.3%) house their sheep in the main house together with the family. Separate sheep house was also reported by some farmers across all the woreda. However, the proportion of farmers using Kitchen to house sheep is negligible and limited to Mareka and Konta woreda only.

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Table 11 : House types for sheep in the study area

House types	Tocha		Mareka		Konta	
	N	%	N	%	N	%
In the main house	46	82.1	40	67	41	68.3
Separate sheep house	10	17.9	19	32	13	21.7
Kitchen	–	–	1	1.7	6	10

j) Fattening and castration sheep

i *Fattening*

Sheep fattening is practiced by 89.7% farmers in Tocha, 100% farmers in Mareka and 93.3% farmers in Konta woreda. This study demonstrates that majority of the male sheep in a household is kept for fattening purpose and sold at an early age. Among the feed types used for fattening across all the woreda, natural pasture (grazing), crop residue, local brewery residue (*atella* of *katikalla* and *tella*), grain, salt, leaf and root of sweet potato, concentrate and improved forge were the major feed resources used for fattening. In the study area, fattening usually practiced following the end of the main rainy season and in the beginning of dry season coilciding with the availability of good quality and quantity natural pasture, better forage production and aim to specific market (holiday market). Some farmers also reported that they perform fattening activity twice a year, during the time when the quantity and quality of available feed resource is high.

ii *Castration*

Tocha (77.8%), Mareka (84.7 %) and Konta (96.7%) sheep owners practiced castration. All sheep owners in three districts use traditional castration method to castrate their sheep by crashing the vas deference using stone. Majority of the Tocha (64.3%), Mareka (100 %) and Konta (93.2%) rams were castrated from 6 month to 18 month of age. Farmers believed that castration at early age affect the growth of the sheep.

Castration was primarily practiced to improve the fattening potential in all districts. In the study area the aim of castration was to sell at higher price and gaining much profit form fattened sheep. Tocha (90.5%), Mareka (92.3%) and Konta (86.2%) farmers gave more attention for fattening while 4.8% of Tocha and 3.4% of Konta farmers castrate their sheep to avoid unnecessary mating. In some rare cases, farmers in Tocha (2.4%) and Konta (6.9 %) castrate rams to improve ram temperament so as to avoid ram run from the flock.

k) Source and Current status of Dawuro and Konta sheep types

In this study, focal group members (key informant) believed that Dawuro sheep breed was kept for long past by their ancestors and transferred to the current generation. They pointed out that this sheep type is distributed to Jimma (Oromiya) and Konta special woreda from Dawuro zone. They strongly believe that no any other sheep breed entered in to the flock from the neighboring zones and woreda. However, to somehow, they agree on similarities between Keffa (Bonga) and Dawuro sheep in their appearance, even though the two breeds are different in various characters. Example Keffa sheep is large in body size than Dawuro sheep and have got relatively long and wide tail. Zewdu (2008) reported that Bonga sheep had wide and long tail with straight pointed end and twisted end. As indicated by Tsedeke *et al.*, (2011) Sheep from Adilo, Alaba, Kambata Tambaro, Dawuro, Wolaita, Gamo Gofa and Hadiya areas of the SNNP region are collectively called 'Wolaita sheep' and according to the morphological and molecular characterization work of Ethiopian sheep breeds by Solomon(2008) the Dawuro type are categorized under breed of Arsi and population of Arsi-Bale and Adilo.

Focal group members recognized that starting from long past selection against the horned sheep was practiced by their ancestors and still they believed that horned sheep are very thin, stunted growth and low quality for meat. Consequently, the present Dawuro sheep population is almost hornless.

On the other hand, key informant in Konta special woreda believed that the Konta sheep inter in to the special woreda from the neighboring zone of Keffa through marketing exchange. Group members also indicated that the sheep population of Dawuro and Konta are currently at increasing trend because of increased awareness towards the better market opportunity created this time. Thus, today sheep populations of Dawuro and Konta are marketed and distributed to Jimma (Oromiya zone) and Chida (the capital of the special woreda).

l) Typical Features of Dawuro and konta Sheep Types

For both Dawuro and Konta sheep, fattening potential, twining rate, short lambing interval and resistance to disease and cold climatic condition are considered as special merits of the sheep types. The coat color is dominated by dark and light red brown (Figure 4) and the tail is wide and long with straight pointed end and twisted end. Male and female are hornless (polled), the ear is long, and the hair is short and smooth. Similarly Zewdu (2008) reported that Bonga sheep population resembles that of Dawuro and Konta sheep types.

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Figure 4 : Sheep from Dawuro (left) Sheep from Konta (right)

m) Effective Population Size and Level of Inbreeding

Phenotypic diversification of sheep breed can be resulted after the process of interbreeding of different populations. On the other hand, homogeneous sheep breed can be the result of the effect of inbreeding where increased level of inbreeding and decreased genetic diversity may be the result of the utilization of breeding ram/s born with in the flock, small flock's size, random mating and lack of awareness about inbreeding. In this study the small number of breeding ram per household is believed to increase the level of inbreeding. The effective population size (Ne) and the rate of inbreeding coefficient (ΔF) calculated for Tocha, Mareka and Konta sheep are presented in Table 12. When sheep flock of a household were not mixed, ΔF for sheep in Tocha, Mareka and Konta were 0.17, 0.20 and 0.18, respectively. The value was higher than the maximum acceptable level of 0.063 (Armstrong, 2006). For Tocha sheep, Ne was higher than the Ne of the other two districts but ΔF was higher (0.2) for Mareka sheep. The result was also higher than what has been reported for Chena (0.0998), Gesha (0.1199), Semien bench (0.1873) and Debub bench sheep (0.0833). Tesfaye (2008) reported lower ΔF of 0.079 than the present result for Menz and 0.2 for Afar sheep.

Table 12 : Effective population size and level of inbreeding when flocks of sheep are not mixed in Dawuro (Tocha and Mareka) and Konta woreda

District	When flocks are not mixed			
	N_m	N_f	N_e	ΔF
Tocha	1.05	2.37	2.91	0.17
Mareka	1.08	1.48	2.5	0.20
Konta	1	2.18	2.74	0.18

N_e = effective population size; ΔF = coefficient of inbreeding. N_m = number of male; N_f = number of female.

n) Coat Color Preferences

Farmers in Tocha and Mareka prefer a particular coat color such as red (solid or light), brown, (solid or light), grey and white. However, they give less attention for black coat colour. Preference of farmers for a particular coat color might be associated with belief, market demand and socio-cultural practices. Like Dawuro (Tocha and Mareka), farmers in Konta also give more attention for red (solid or light), brown, (solid or light), and grey coat colour. In contrast to Dawuro zone, black and white colour was not preferred at all in Konta special woreda. In general, this study showed that black colored sheep are less preferred by almost all respondents across all the districts. The damaging effect of predator on sheep production around Konta is very common. Thus, white color is less preferred by Konta farmers since they believe that white colored animals are easily attacked by predator, disease and harsh environment.

o) Disease

It is well documented that disease control is very basic for genetic improvement of livestock (Solomon, 2007). Healthy sheep with normal physiological function and structure that enable the sheep to attain highest production is vital. In this study internal and external parasite, Diarrhoea and *megaga (local name) were* the most frequently reported diseases

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of sheep across all the studied woreda (Table 13). Almost all farmers in Mareka, 91% in Tocha and 75% farmers in Konta use modern drugs to treat their sheep against the disease.Similarly about 92.9 %, 100 % and 68.3% of farmers in Tocha, Mareka and Konta woreda, respectively, get veterinary service from governmental clinics. However about 1.8% and 5.4% farmers in Tocha use private clinic and simple drugs from open market. About 6.7% farmers in Konta used drugs from open market while 25% get veterinary service from both governmental clinic and shop/open market. The majority of farmers had access to veterinary services in less than one km distance. Only 1.8% farmers in Tocha and 6.7 % farmers in Konta travel about 15km to get veterinary service. On the other hand 8.8% of farmers in Tocha, 33.3% in Mareka and 11.7% in Konta travel 6km for veterinary service.

Table 13 : List of diseases reported by farmers in the study woredas

Woreda	Common name of the disease	Local name of the disease	No	%	Description of the symptoms
Tocha	Pasteurellosis	-	1	1.67	-
	Sudden death	*Attadafi*	4	6.67	Acute death of sheep
	Coccidosis	*Azurit*	1	1.67	Emaciation and anemia
	Internal and external parasite	*Tegega tewasiyan*	13	21.7	Rough hair, loss of appetite and Diarrhea
	Common cold	*Sal*	4	6.67	Coughing
	-	*Yechenkelat mabet*	8	13.3	-
	-	*Megaga*	9	15	Unable to balance head
	Diarrhea	*Kezen*	20	33.3	Diarrhea
Mareka	Internal and external parasite	*Tegega tewasiyan*	34	56.7	Rough hair, loss of appetite and diarrhea
	-	*Megaga*	6	10	Unable to balance head
	Diarrhea	*Kezen*	20	33.3	Diarrhea
Konta	Internal and external parasite	*Tegega tewasiyan*	19	31.7	Rough hair, loss of appetite and Diarrhea
	Common cold (coughing)	*Sal*	3	5	Coughing
	-	*Megaga*	14	23.3	Unable to balance head
	Diarrhea	*Kezen*	24	40	Diarrhea

p) Docking

In this study farmers reported that docking is practiced by 93% of farmers in Tocha, 96.7% in Mareka and 90% in Konta. According to the respondents, docking female sheep was done for various reasons. Thus, all the sampled farmers in Tocha, 86.2% in Mareka and 59.6% in Konta woreda reported that they practice docking for fattening (farmers believes that undocked ewe could not gain body weight easily), ease of mating (enable the ram to mate easily), ease hygiene during delivery and to have better market price (docked ewe has better market demand than their undocked contemporaries).

q) Sheep Disposal and Market Age

The average market and culling age of sheep in Tocha, Mareka and Konta are presented in Table 14. The average market age of male sheep in Tocha, Mareka and Konta was 11±2.74, 11.4 ±1.37 and 12.43 ±4.8 months, respectively. Similarly, females are sold at an age of 12.78 ±2.46, 12.05 ±2.19 and 13.8 ±5.7 months in Tocha, Mareka and Konta, respectively. This shows that male sheep are marketed at earlier age than female sheep in order to generate immediate cash income, however, female sheep are marketed when there is serious money shortage. Dawuro sheep are highly preferred and get highest prices due to their pleasant flavor and tender meat, high carcass and edible non-carcass component yields and high aesthetic value (Tsedeke *et al*., 2011). Most of the time selling and buying process of sheep were carried out in big nearby markets on market days of the week. However, it is not uncommon to sell sheep any day of the week mostly to local traders and to lesser extent to consumers and other farmers. Upon collection of sheep from farmers, local traders in turn sell sheep to traders from nearby zones, who ultimately truck/trek sheep to the nearby cities, mainly to Jimma and Wolayita (Figure 5). Some time the process of marketing sheep takes place without the participation of local traders in which case farmers sell their sheep directly to the main traders.

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Figure 5 : Konta sheep being trekked to Jimma city for sell

Though shortage of capital force farmers to sell their sheep any time of the year, , farmers usually prefer to sell their sheep in particular time of the year especially during local holidays and festivals (E.g. Ethiopian New Year, Christmas, Epiphany, Easter, *Meskel*) .because of high demand and better price for sheep meat. However, farmers across all the woredas stressed that long distance trekking of sheep due to inadequate transportation facilities, fluctuation of market price of sheep and lack of market information system are the major problems that challenge sheep marketing.

Table 14 : Average marketing and culling age of sheep (mean ± SD) in the study area

Woreda	Parameter	N	Mean ± SD
Tocha	Market age (months)		
	• Male	58	11.0±2.74
	• Female	58	12.7±2.46
	Culling age (months)		
	• Male	58	35.1±6.36
	• Female	57	35.1±13.2
Mareka	Market age (months)		
	• Male	58	11.4±1.37
	• Female	59	12.0±2.19
	Culling age (months)		
	• Male	60	35.6±8.76
	• Female	59	77.0±15.72
Konta	Market age (months)		
	• Male	60	12.4±4.8

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• Female	60	13.8±5.7
Culling age (months)		
• Male	60	39.9±7.2
• Female	60	72.9±12.36

The average culling (withdraw from breeding) age of male sheep in Tocha, Mareka and Konta was 2.93, 2.97 and 3.33 years, respectively. In Tocha females culled at the age of 6.07 years, while in Mareka and Konta it is 6.42 and 6.08 years, respectively. Mostly culling of breeding ram was accomplished to fulfill immediate need of cash and when the animals faced health problem. When farmers need instant money they give priority to sell their sheep. Ranking of selling priority of sheep is presented in Table 15. In Tocha castrated sheep, ram lambs and ram are sold first, second and third with index of 0.205, 0.2 and 0.199, respectively. Similarly in Mareka castrated sheep, breeding ram and breeding ewe were sold first, second and third with index of 0.3, 0.22 and 0.21 respectively.

Castrated sheep, ram lambs and aged ewe, were sold first, second and third with index of 0.19, 0.16 and 0.128, respectively, in Konta woreda.

Table 15 : Ranking of selling priority for different sheep category

District and sheep category	Rank1	Rank2	Rank3	Index	Rank
Tocha					
❖ Ram lambs	75	25	0	0.2	2
❖ Ram	80	8.6	11.4	0.199	3
❖ Ewe	0	95.2	4.8	0.145	5
❖ Breeding ram	5	20	75	0.096	6
❖ Castrated	76.3	23.7	0	0.205	1
❖ Aged ewe	0	66.7	33.3	0.148	4
Mareka					
❖ Ram	25	57	17.5	0.22	2
❖ Ewe	0	100	0	0.21	3
❖ Breeding ewe	0	40	60	0.15	4
❖ Castrated	81.4	18.6	0	0.3	1
❖ Aged ewe	0	3	97.3	0.11	5
Konta					
❖ Ram lambs	50	50	0	0.16	2
❖ Ewe lambs	25	25	50	0.116	4
❖ Ram	16.7	14.3	69	0.098	6
❖ Ewe	9.1	45.5	45.5	0.108	5
❖ Breeding ram	0	27.8	72.2	0.08	8
❖ Breeding ewe	0	50	50	0.09	7
❖ Castrated	98.2	1.8	0	0.19	1
❖ Aged ewe	2	90	8	0.128	3

r) Constraints of Sheep Production

Identifying the obstacles of sheep production is a base to solve the problem and to improve sheep genetic resource and sheep productivity. Thus, major constraints challenging sheep production in the study area are presented in Table 16. This study demonstrated that disease and feed shortage are the major constraints challenging sheep production across all the studied woreda. In Tocha disease accounted for the lions share (index=0.35) followed by feed shortage (index=0.30). In Mareka, however, feed shortage was the major constraint with the index of 0.29 followed by disease (index=0.24). Farmers in Konta special woreda ranked disease as a primary problem (index=0.22) followed by feed shortage (index=0.19). Shortage of labor was reported as a limiting factor for sheep

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production in Tocha (index=0.21) followed by Mareka (index=0.14) and Konta woreda (index=0.12). Even though predator was not a major concern in Tocha woreda, it was reported to be a major problem in Konta (index=0.19) followed by Mareka (index-0.18). Genotype was considered as a problem across all the woreda, but it was not serious problem in Konta (index=0.09) as compared to Mareka (index=0.14) and Tocha (index=0.12).

Table 16 : Major constraints of sheep production in the study area

Woreda	Constraints	Index
Tocha	Disease	0.35
	Feed shortage	0.30
	Labor shortage	0.21
	Genotype	0.12
Mareka	Feed shortage	0.29
	Disease	0.24
	Predator	0.18
	Labor shortage	0.14
	Genotype	0.13
Konta	Disease	0.22
	Feed shortage	0.19
	Predator	0.19
	Labor shortage	0.12
	Genotype	0.09
	Water	0.07
	Market problem	0.07

IV. Summary and Conclusion

Planning of any breeding program including community based breeding strategy and /or breed improvement scheme needs the identification of genotypic and phenotypic traits of the particular sheep breed and also to know the genetic ability of that breed and the production environment that can influence productivity of the animal. The study was conducted in Dawuro zone and Konta special woreda of South Nations Nationalities and Peoples Regional State of Ethiopia. Even though the study areas are rich in livestock resources including small ruminants, nothing has been done to characterize, identify and document the existing indigenous sheep types and its production system.

A total of 180 households were selected for production system characterization, and 630 mature sheep were sampled for phenotypic characterization of sheep population (qualitative and quantitative characters).The study revealed that, mixed crop-livestock production system was the dominant form of production system across all the locations considered. In Dawuro zone (Tocha and Mareka) and konta special woreda, farmers grow mainly barley, wheat, *teff*, sorghum, maize, been, peas, taro and *enset* (*kocho*) and posses different species of livestock cattle, sheep, poultry, donkey, mule, horse and goat. The average number of sheep per household in Tocha, Mareka and Konta was 11.43, 9.66 and 10.75 sheep, respectively. Ewes older than 1 year accounted for the largest proportion in Tocha (2.37±1.31) and Konta (2.18±1.33) sheep flock, while ram lambs aged less than 6 months accounted for the highest proportion in Mareka sheep flock. Farmers keep male sheep mainly as an asset (saving) and income generation, and female sheep for breeding and as an asset as well.

Natural pasture and crop residue were the main feed sources during rainy and dry seasons across all the woreda. The main source of water for sheep in the study areas were rivers and spring water, and the majority of farmers reported that they allow their flock to get watered as they needed and when they want.

Mostly, sheep get shelter inside the main house. As well as separate sheep house and kitchen were also reported as sheep houses in rare case. Fattening and castration was practiced by almost all sheep keepers.

Random mating or uncontrolled breeding, as a result of communal grazing and common watering point, was the common breeding practice in the study area. Most of households keep only one breeding male

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and do not permit inbreeding. All farmers in Mareka and most farmers in Tocha and Konta select breeding ram and ewes based on physical appearance and coat color.

Sexual maturity (age at puberty) was 11.05±1.6, 10.88±1.7 and 9.5±1.4 months for males and 11.13±2.7, 10.8±1.9 and 9.5±1.4 months for females in Tocha, Mareka and Konta, respectively. In this study the average age at first lambing for Tocha, Mareka and Konta sheep was 12.88±1.7, 14.75±1.8 and 14.77±1.8 months, respectively. The average lambing interval for Tocha, Mareka and Konta sheep was 11.62±3.8, 10.33±4 and11.02±3.8 months, respectively The average reproductive life span of Tocha, Mareka and Konta ewes were 9.17±1.70, 9.82±1.51and 9.28±1.62 years, respectively. The results of this study showed that on average an ewe can produce 8.57±3.7 (Tocha), 8.62±4.1 (Mareka) and 10.78±4.7 (Konta) lambs in her life time. Twining rate was reported to be higher for Konta (39.06%) and Mareka (37.8%) as compared to Tocha (24.75 %) sheep.

Internal and external parasites, Diarrhoea and *megaga (local name)* were the major diseases reported for sheep in all the woreda. Feed shortage and disease are the major production constraints in all the woreda. The other problem of sheep production in Mareka and Konta was predator; especially in Konta special woreda the problem was sever. Majority of the sampled farmers in the study area practice docking.

On the other hand,

Increased level of inbreeding and decreased genetic diversity may be the result of the utilization of breeding ram/s born with in the flock, small flock's size, random mating and lack of awareness about inbreeding. In this study the small number of breeding ram per household is believed to increase the level of inbreeding.

V. Recommendations

As farmers pointed out the main obstacle for the sheep production in the study area was disease. Thus, efforts should be geared to control the disease such as detail study and identification of major sheep diseases, planning of adequate health control measures and working for its implementation and fast and efficient vet service. Traits which are very important in sheep productivity are the outcome of genotype and environment. Thus supply of feed (quantity and quality) both during the dry and rainy season should be improved. Establishment of standardized marketing systems with market information system, and infrastructure should be in place.

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Note :

"

- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
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- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

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Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
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- Submitting a manuscript with pages out of sequence

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· Use paragraphs to split each significant point (excluding for the abstract)

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· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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Abstract:

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An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

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- Fundamental goal
- To the point depiction of the research
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- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
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- Center on shortening results - bound background information to a verdict or two, if completely necessary
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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
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Approach:

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- Report the method (not particulars of each process that engaged the same methodology)
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- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
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Approach:

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What to keep away from

- Resources and methods are not a set of information.
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The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

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Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
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- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

A

Assess · 27, 81

C

Campylobacter · 11
Canopy · 30, 32, 34, 36, 37
Castration · 85, 101, 112

D

Deterioration · 46, 71

F

Fecundity, · 63
Fences · 83

G

Gariepinus · 61, 63, 65, 67, 69, 71, 72, 73, 74, 75, 77, 78, 79
Gelişmiş · 1

P

Podzolic · 46
Proliferation · 9, 71

S

Sickle · 30, 32, 34, 36, 38
Spoilage · 11, 13, 61, 71

T

Tüketimi · 1



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