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Analysis of Comparative Advantage of Irrigated Wheat vs Onion production in East Shewa Zone, Oromia

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Abstract

To alleviate poverty the government of Ethiopia has initiated wheat self-sufficiency strategies through increasing wheat productivity in the rain-fed agro-ecologies and expansion of production to the irrigable lowland areas using cluster approaches. This study was conducted in Dugda Woreda, East Shewa zone of Oromia region with objective of identifying comparative advantage of onion and irrigated wheat production. Both primary and secondary sources were used for data collection. The primary data was collected through interviewing from 100 sample households using semi-structured questionnaires. Qualitative data was collected through focus group discussions, and key informants interviews using checklists. STATA version 15 Software was used for data analyzing. As the descriptive result of the study indicate that, on average, sample household owned livestock of 6.35 TLU, farmers general farm and wheat farming experience of were about 23.15 and 13.25 years respectively, having the onion farming experience of 5.94 years. This implies that the producers can increase the efficiency as their experience increase since they were work age groups. As the study result confirm that farmers in the study area hold a mean of 1.44 ha of cultivated land in the survey year from which they allocate 1.04 and 0.40 ha for irrigated wheat and onion, respectively with the productivity of 280 qt for onion and 40qt for irrigated wheat. The average total variable cost for onion and irrigated wheat production were 728,180 ETB and 130,280 ETB/ha, respectively. The net profit gained from onion and irrigated wheat production per hectare was 951,820 ETB and 89,720 ETB, respectively which is very high for onion production but very low for irrigated wheat production. The Benefit-Cost Ratio for onion production was 2.307 whereas its 1.688 for irrigated wheat production suggesting the benefit gained from one (1) birr expenditure is 2.307 birr for onion production. Therefore, comparatively producing onion is better than producing wheat by irrigation. Therefore, a compensations is needed from government for smallholder farmers if irrigated wheat have to be produced for export of wheat. In the mean-time Government should produce irrigated wheat based on farmers willingness and as crop rotation in the study area and Irrigated wheat should be applied for famers that unable to produce onions and where production cycle twice a year as crop rotation. In general for more conformation detail research is needed for policy option in this study topic. In the mean-time a new variety of wheat which cannot be attacked by Quelea bird (Girrisa) should be developed by any concerned body.

Keywords: Onion, Irrigated wheat, Cost-benefit, Comparative advantage, East Shewa zone

1. Introduction

1.1 Background and Justification

Agriculture is the main stay of Ethiopian economy contributing about 44% of the Gross Domestic Product (GDP), 80% of employment and 90% of the export. However, agriculture continues to face a number of problems and challenges. The Ethiopian Government attempts to promote production and marketing of irrigated wheat with a view to decreasing import wheat or import substitution, and largely producing irrigated wheat on the potential land for vegetable. Irrigation based Wheat instead of onion were first introduced to Ethiopia in last few years.

Irrigation based wheat and onion is one of the most important sources of on-farm income for the farmers in Ethiopia. In areas where there is relatively good market infrastructure, wheat and onion were become the leading cash crop and to farmers East Shewa Zone is one of a major irrigation based wheat and onion producing zone in Oromia Region with a potential representative district. The Ethiopian economy is heavily dependent on the agricultural sector for foreign exchange earnings, employment, income generation, and Food security.

Despite of its importance its production and productivity is very low because of our scarce resource misallocation (Leggese *et al*., 2004). The major problems in irrigated based onion vs wheat production and marketing are; their comparative advantage is not done so far. In the mean-time low yield of wheat especially during dry season as it was affected by birds, the most economically viable for farmers was not clearly known even to consider the composition for farmers. Therefore, assessing and improving markets are necessary to link smallholder to the most profitable markets in order to expand demand products as well as set opportunities for income generation. Hence, this study proposed to fill the gaps by identifying comparative advantage and major constraints, opportunities and improving irrigation-based wheat vs onion producer markets.

1.1 Objectives of the Study

- ✓ To identify most benefiting crop for the farmer.
- ✓ To identify production constraints and opportunities of irrigated based wheat vs onion production
- ✓ To assess farmers feedback towards irrigated based wheat vs onion production in the study area.

2. Methodology

2.1 Description of the Study Area

This study was conducted in East Shewa zone, Oromia regional national state.

2.2 Sampling Procedure and Sample Size

Three stage sampling were implemented for this study. **First stage:** Potential district (Lume) for both wheat and onion production is purposely selected. **Second stage:** Four Kebeles (Shara Dibandiba, Ejersa Jorro, Ungugi Bekele and Koko Nagawo) were selected purposively based on potential of onion & irrigated wheat. **Third stage:** Wheat and onion producer households were randomly selected from a list of irrigated wheat and onion producer farmers by probability proportional to size (PPS) of producer households using Yamane (1967) sample size determination formula as follow:

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = is the sample households produced wheat and onion, N = is the total number of

households wheat and onion producer and e = 0.09 is the level of precision defined to determine the required sample size at 90% level of precision. The sample sizes selected from each kebele were determined using probability proportional to size (PPS).

2.3 Data Type, Sources and Method of Data Collection

Both primary and secondary data sources were used in the study. The primary data sources was collected by using semi-structure questionnaires, interview, discussion, and observation. Secondary data was collected from related articles, books, publications and stakeholders records such as Ministry of Agriculture (MoA), Ethiopian Central Statistical Agency, Zonal Office of Agriculture and Natural Resource management, Woreda Office of Agriculture, Union and primary farmers' cooperatives, and Logistics providers (credit providers if any) by using checklists.

2.4 Methods of Data Analysis

Descriptive Statistics: The study was used descriptive statistics such as frequencies and means to analyze the socio-economic characteristics of irrigated wheat and onion producing farmers. Cost benefit and gross margin analysis was used to assess economic analysis of smallholder farmers in irrigated wheat and onion production.

Total farm revenue using the formula $P \times Q$, where P is price of the output and Q is the quantity produced. Total expenditure using formula WX, W price of input and X quantity of input Farm level profit (π) will be computed as the difference between the total revenue and total variable cost expended on producing the crop i.e. **[Gross Margin (π)= $PQ - WX$].**

Cost-benefit Analysis (CBA): Evaluation of economic returns plays crucial role in influencing farmers' choice to adopt improved agricultural technology and consequently influences farmers' resource allocation decisions. Understanding of costs and benefits is also an important pre-requisite for policy formulations aimed at improving productivity levels. Different scholars used cost benefit Analysis to measure smallholder farm profitability.

Gross Margin Analysis: Johnson defines gross margin as the difference between the value of an enterprise's gross output and variable cost of production. Gross margins are used to evaluate economic viability of an enterprise. They are used in agriculture for farm planning and comparing different farms with similar characteristics or different enterprises on the same farm.

3. Result and Discussion

3.1 Socio-Demographic Characteristics of Sampled Households in the Study Area

The average age of the sample households during the survey period, was about 41.82 years having farming experience 23.15 years which was less than 65.97 year of average life expectancy for both sex in Ethiopia (WPP, 2017). Based on Strock *et al.,* 1991 (as cited in Ermiyas ,2013) this average value of age included in the most economically active age group of 17-50 year.

The average education level of literate sample household heads during survey period was about 6.4 years with the minimum of zero years (illiterate) and maximum of 12 years. Family size plays an important role in crop production and most farmers depend mainly on family labor. The average family size of the sample households was 6 persons per household (Table 1) which is greater than 4.6 persons per household as Ethiopia, based on household size and composition around the world in 2017.

On average, sample household owned livestock of 6.35 TLU. This indicates that the farming system in Ethiopia is mainly based on plough by animal draught power that has created complementarity between crop and livestock production (Table 1). As Table 1 shows the average general farm and wheat farming experience of the sample households were about 23.15 and 13.25 years respectively, having the onion farming experience of 5.94 years. This implies that the producers can increase the efficiency as their experience increase since they were work age groups.

Table 1. Socio-demographic Characteristics of smallholder farmer in the study area

Demographic Characteristics	**Total Sample (n=100)**	
	Mean	**Std. Dev**
Age of HH head	41.82	12.32
Agricultural farm Experience	23.15	12.27
Farm experience wheat production	13.25	9.81
Experience in onion production	5.94	3.84
Households Family Size	6	2.99
TLU	6.35	3.37
Grade Level	6.34	2.74

Source: Survey result of 2023

3.2 Land Holding Arrangement of Sample Households

Land holding and ownership is crucial factor for agricultural production. It is the most important production resources base for any economic activity especially in rural and agricultural sector. Five land holding arrangement were practiced by the sample household farmers in the study area namely own cultivated land, land shared in, land shared-out, rented-in land, rented-out land arrangements. Owned land refers to a land which exists on a legal land certificate given by land authorities. Cultivated farmland is land used by sample

farm households to undertake agricultural production. It is an effective farm land amount used by sample households to undertake agricultural production. Sample households were found to hold a mean of 1.44 ha of cultivated land in the survey year from total land holding of 2.29ha from which they allocate 1.04 and 0.40 ha for irrigated wheat and onion, respectively.

Table 2. Land holding arrangement of sample households

Variables	**Total sample (n=100)**	
	Mean	**Std. Dev.**
Land cultivated by Rainfed	0.85	0.51
Land cultivated by Irrigation	1.44	0.67
Total Land cultivated	2.29	0.96
Land allocated for irrigated wheat	1.04	0.54
Land allocated for onion	0.40	0.21

Source: Own survey result, 2023

3.3 Production and Profitability of Irrigated Wheat and Onion in the Study Area

Onion and Irrigated wheat production in the study areas

Onion is one of the most important and widely grown vegetable in Ethiopia in general and the study area in particular. onion was produced more than two times in the study area due to the availability of irrigation. The average onion productivity is 280 kuintal /ha in the study area whereas the average productivity of irrigated wheat was 40 kuintal per hectare.

The major onion variety used for the production in the study area was Bombe variety, whereas Nafis and Red coach onion variety was also used sometimes by smallholder farmers in the study area. Amount of bombe onion seed used per hectare is 22kg with the price of 5500 birr/kg whereas Nafis and red coach was 8-12kg and 4kg per hectare respectively with the price of 6000 and 20,000 for both above mentioned variety. The major wheat variety used for production was kingbird and wane in the study area. Total amount of wheat seed used for production in the study area was 2 quintals per hectare. Onion producers used different types of chemicals for onion protection. The types of chemicals that widely applied by farmers in tomato production were Mancoziem (33.03%), mancozied and selecron (17.43%), mancozed, redomile and agrolaxine (13.76%), mancozeb, selecron and redmole (13.76%), mancozeb, redmole, malatine and coside (9.18%). The farmers in the areas purchased chemicals from

Private retailers (93.4%), and cooperative/union (4.7%). As the study result report revealed that farmers use hired and family labor for onion and irrigated wheat production. However, the major source of labor for onion and irrigated wheat production is from market hire which accounts for 66.36% in addition to family labor indicating onion and irrigated wheat production is labor intensive.

3.3 Profitability of Onion and Irrigated Wheat Production in the Study Area

In Table 3, production cost was calculated for seed, fertilizer, human labor, pesticide, irrigation, etc. The average total variable cost for onion and irrigated wheat production were 728,180 ETB and 130,280 ETB/ha, respectively. The net profit gained from onion and irrigated wheat production per hectare was 951,820 ETB and 89,720 ETB, respectively which is very high for onion production but very low for irrigated wheat production. The Benefit-Cost Ratio for onion production was 2.307 whereas its 1.688 for irrigated wheat production suggesting the benefit gained from one (1) birr expenditure is 2.307 birr for onion production. Therefore, comparatively producing onion is better than producing wheat by irrigation.

Table 3. Production and Profitability of Irrigated wheat vs onion in the study area

	Onion			**Irrigated Wheat**		
Item	**Quantity**	**Unit Price (ETB)**	**Total (ETB)**	**Quantity**	**Unit Price (ETB)**	**Total (ETB)**
Total Revenue	**280 Qt**	**60**	**1,680,000**	**40 Qt**	**5500**	**220,000**
Variable cost						
Seed	22kg	5500	121,000	2Qt	7000	14,000
Fertilizers	NPS 8Qt	3570	28,560	2Qt	3,570	7,140
	UREA 6Qt	3570	21,420	2Qt	3,570	7,140
Chemical	In General Chemical Costs		200,000			40,000
Fuel	520 litters	100	52,000	120 litters	100 birr	12,000

Land preparation and Planting			36,000		18,000
Transplanting	120 person	300birr/person	36,000		
Weeding	240 person	500birr/person	120,000	Protection of Quelea bird	20,000
Cleaning	40 person	500birr/person	20,000		
Watering	16 times	700 birr/one	11,200	Watering for irrigated wheat 8	5,600
Digging	80 person	500birr/person	40,000	Harvesting	12,000
Cutting	56 person	750birr/person	42,000		
Total Cost		**728,180 ETB**		**130,280 ETB**	
Net benefit	**951,820 ETB**			**89,720 ETB**	
Benefit-Cost Ratio			**2.307**		**1.688**

Source: Own computation based on survey data (2023)

3.5 Farmers Perception from Perspective of Financial Gain on Irrigated Wheat and Onion

About 90% sample households perceived irrigated wheat production was disadvantageous whereas only 10% perceive positively from perspective of financial gain, this is may be due to cash crop of onion in the study area for long period of time (Table 4).

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Table 4. Perception of farmers on irrigated wheat production from perspective of financial gain

Perception	**Total sample (n=100)**	
	Freq.	**%**
Negative	90	90
Positive	10	10
Total	**100**	100

Source: Survey result of 2023.

3.6 Compatibility of Onion Production in the Study Area

As the study result indicates (Table 5) below, the mean value of perception of the sample household about the compatibility of onion is 3.94 suggesting the farmers perceive it's compatible and profitable than irrigated wheat.

Table 5. Compatibility perception of smallholder farmers on onion production

Variable	**Observation**	**Mean**	**Std. Dev.**	**Min**	**Max**
Compatible	100	3.94	0.544	0	5

Source: Survey result, 2023.

3.7 Challenges and Potential of Onion Production and Marketing

Table 6. Challenges & potentials of onion production and marketing

Value chain stages	**Constraints**	**Potentials**
Input supply	High cost of inputs	High demand for improved seed
	Unstainable seed source and low quality seed	Short distance travelled to get inputs
	Shortage and Unavailability of inputs on time	Existence of input suppliers
	Shortage certified chemicals	
Production	High production costs	Enabling policy environment
	Disease, pests (*Tuta Absoluta*) and fungal disease ((leaf blight and early leaf blight)	Support from government and non- government organizations
	Shortage of quality seed	Access to irrigation water
	Perish ability nature of the product	
	Over dosage of chemical application	
	High post-harvest loss	
	Lack of storage	
Marketing	In adequate market information	Access to road and transport
	Brokers interference	Good market demand of the product
	Market price fluctuation	Establishments of credit providers

	Perish ability nature of product	
	Capital shortage	
	Weak linkage along value chain actors	
	Lack of storage	
Consumers	Poor quality of product	High consumption preference
	Shortage of capital	Availability of product on the market
	High price of the product	

Source: FGD, KII and survey data (2023).

Challenges and opportunities on irrigated wheat production and marketing

Even-though the regional government in collaboration with other concerned institutions supported the irrigation farm households with different input and credit services, technical supports and supportive policies, the farm households has pointed out some limitations which affect the irrigation performance negatively during the study. A field survey with sampled respondents indicates that irrigated wheat production great benefits are accompanied with multidimensional challenges.

Challenges: As FGD and KII indicate that, irrigated wheat highly attacked by bird/*Girrisa*. In the mean-time monocropping was also the major problem of irrigated wheat production. The key informant interview and FGD figured out the following major constraints in the study area. The lack of fair price for the wheat in the market. Shortage of seed and different inputs. Shortage of fuel, water pump and price of fuel. During focus group discussions (FGDs) and key informant interviews, respondents were also reported that the governmental water sectors should solve the major irrigated wheat production problems identified during the survey include financial constraints especially for the purchase of motor pumps, shortage of agricultural inputs like improved seed and pesticides, supply of spare parts, technical supports such as maintenance of motor pumps. The other one is price of wheat, supply of fuel and attack of birds.

Opportunities: According to the information collected from focus group discussions and key informant interviews, the overall opportunities for the development and management of irrigation water are the availability of high surface water potential in the area, wide range of technologies are now exists countrywide and can be also adapted to the local situation. The other opportunity is that there is availability of favorable climate condition and ground water

in the area. It can be used as an opportunity to produce more than once a year if the farmers could be able to access the ground water by means of treadle pump, hand pump and motor pump, even though the motor pump was indicated as costly both for buying and the energy required in terms of fuel. The other thing that can be taken as an opportunity for irrigation development in the study area is a great emphasis given for irrigation development by the government at country level.

4. Conclusion and Recommendations

4.1 Conclusion

To alleviate this challenge the government of Ethiopia has initiated wheat self-sufficiency strategies through increasing wheat productivity in the rain-fed agro-ecologies and expansion of production to the irrigable lowland areas using cluster approaches. This study was conducted in Dugda *Woreda,* East Shewa zone of Oromia region with objective of identifying cost-benefit of onion and irrigated wheat production. Both primary and secondary sources were used for data collection. The primary data was collected through interviewing 100 sample households using semi-structured questionnaires. Qualitative data was collected through focus group discussions, and key informants interviews using checklists. STATA version 15 Software was used for data analyzing.

The government of Ethiopia has initiated wheat self-sufficiency strategies through increasing wheat productivity in the rain-fed agro-ecologies and expansion of production to the irrigable lowland areas using cluster approaches. Wheat and onion are an increasingly important food crop in our country. Expansion of wheat production in irrigated areas will be limited to yield increases unless wheat substitutes for competing crops. To some extent, Ethiopian government policy has compensated producers through subsidies on irrigated wheat inputs.

The present study was carried out to compare the economics of irrigated wheat and onion based on the field survey. Present study clearly indicates that onion producer farmers gain better farm profit compared to irrigated wheat producer farmers. Even-though, onion is a profitable crop, it is very cash cost incentive crop and thereby high cash involvement. In the mean-time, onion production is not without challenges, cultivation of high-value crops involves risks and uncertainty due to high resource requirement and high perishability. Even-though, sample households perceived irrigated wheat production was disadvantageous from financial point of view, this is may be due to irrigated wheat introduced recently and its benefit gained is very low as compared to onion production, they perceived it’s better for food consumption.

4.2 Recommendation

The findings of this study enabled us to make the following recommendations for policy makers, developments actors and researchers who have an interest to work on cost-benefit analysis. The farmers get more benefit when they produce onion than irrigated wheat even-though irrigated wheat is the focus of governmental. Therefore, its recommended that the government have to develops a crop insurance program that subsidizes insurance for growers and makes coverage affordable to farmers. Therefore, a Compensations is needed

from government for smallholder farmers if irrigated wheat have to be produced for export of wheat. The study identified pests, diseases, input costs and inadequate input supply as the major onion production constraints whereas perish ability of the product; poor market information, and capital shortage are also major challenges in onion marketing. Therefore, any intervention aims at onion pests management, diseases control, credit service, and post-harvest management through providing training, deliver disease and pest resistance onion varieties, provide credit service, and timely supplying the required inputs recommended to solve the problems.

In the mean-time also there should be a new variety of wheat which cannot be attacked by bird *(Girrisa).* Experts of agricultural office at different level should give awareness creation especially on low cost of production related to horticultural crops as well as farmers produce themselves rather than rent to individual investors that produce onion since horticultural crops practiced long period of time.

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