VOL 4(2), 64-76
Copyright © Madda Walabu University
ISSN: 2523-1901 (Online)
URL: http://jessd.mwu.edu.et/
Email: JESSDeditorials@mwu.edu.et

JESSD
Journal of Equity in Sciences & Sustainable Development

DOI: https://doi.org/10.20372/mwu.jessd.2021.1525

Full Length Research Paper

Profitability Analysis of Community Based Seed Production of Malt barley and Chickpea in North Western Amhara Region, Ethiopia

Yazie Chanie*
Adet Agricultural Research Center, P.O. Box 08, Bahir Dar, Ethiopia

Article Info

Article History
Received 25 Feb. 2021
Accepted 07 July 2021

Keywords:
Benefits, Chick pea, Costs, Gross margin, Malt barley, Seed system.

Abstract

Formal seed enterprises in Ethiopia focus mainly on maize and bread wheat crops but ignored chick pea and malt barley so that community based seed production scheme is currently underway in Ethiopia including in the study areas. Therefore, this study was carried out to examine the profitability of malt barley and chick pea community based seed production scheme at six woredas in Ethiopia. Crop yield, price and cost was collected using data recording sheets while quantitative data was collected by survey and personal observation using checklists. Descriptive statistics and gross margin analysis method was used to determine the profitability of the community seed production. The results of the profit indicators of the study showed that community based chick pea and malt barley seed production was profitable business enterprise. Chick pea community based seed production enterprises was likely to be more sensitive to yield reduction than to price fluctuations or reductions while that of malt barley responds the same for both price and yield. The gross margin analysis depicted that, community based seed production participant farmers obtained a gross margin of 36,591.25 ETB/ha and 45,004.70 ETB/ha from chick pea and malt barley crops respectively. Moreover, a high benefit-cost ratio value of 4.21 and 3.71 was obtained for chick pea and malt barley respectively. Therefore, chick pea and malt barley community based seed production scheme should be promoted to a wider scale to reach more farmers and unaddressed similar areas by office of agriculture in collaboration with farmers' cooperative unions, seed enterprises and/or universities.

* *Corresponding Email: yaziechanie@yahoo.com*

Introduction

Legumes such as beans, groundnuts, cowpeas, pigeon peas, chickpeas, soybeans, lentils and faba beans play a crucial role in human food and nutrition security, trade and income generation, and the sustainability of agro-ecosystems. For small-scale farmers they double up as cash crops for income and subsistence crops for family nutrition (Ojiewo*et al*, 2018). According to IFPRI, 2010 twelve pulse species are grown in Ethiopia of which, faba bean (*Viciafaba*L.), field pea (*Pisumsativum*L.), chickpea (*Cicerarietinum*L.), lentil (*Lens cultinaris*Medik.), grass pea (*Lathyrussativus*L.), fenugreek (*Trigonellafoenum-graecum*L.) and lupine (*Lupinusalbus L.*) are categorized as highland pulses and grown in the cooler highlands while haricot bean (*Phaseolus vulgaris* L.), soya bean (*Glycine max* L.), cowpea (*Vignaunguiculata*L.), pigeon pea (*Cajanuscajan* L.) and mung beans are predominantly grown in the warmer and low land parts of the country.

Chickpea (*Cicer arietinum*L.) is one of the major pulsesgrown in Ethiopia, mainly by subsistence farmers under rain fed conditions (Bekele and Hailemariam, 2007). The crop provides an important source of food and nutritional security for the rural poor, especially those who cannot produce or cannot afford costly livestock products as source of essential proteins. It ranked second next to Faba bean among legumes, which occupies about 242,703.73 hectares of land with estimated production of 499,425.55tones (CSA, 2018).Two types of chickpea are being grown in Ethiopia in which Desi type chickpea is widely grown while Kabuli types are just beginning to expand in the country recently.

In Ethiopia, Barley (*Hordeum vulgare* L.), ranks fifth next to teff, maize, sorghum and wheat and in the 2017/18 Meher season, about 3.5 million smallholder farmers allocated more about 0.95 million hectares of landto barley cultivation and produced about 2 million tons (CSA, 2018). The share of malt barley production is quite low (about 10-15%) as compared to food barley in Ethiopia despite the country has favorable environment and potential market opportunity (Berhane *et al*. 2016). Malt barleyis used as source of food and raw material for malt factories in Ethiopia.

Seed is one of the most important crop production inputs without which there is no next season's crop. The genotypic and phenotypic traits of a seed determine the productivity in line with the use of other agricultural inputs and improved cultural practices within the crop farming system (Amare, 2015).Seed has to be made sustainably available for all farmers as they significantly improve farmers' income and alleviate poverty.

Seed systems can be either formal or informal. Formal systems generally consist of public sector research institutions, public and private sector agencies producing and marketing seed, and organizations responsible for seed certification and quantity control. Informal seed system consists of large number of farmers who produce both local and improved varieties, market their own production and take care of their own research needs (SetimelaandKosina, 2006).The private sectors tend to concentrate on producing seeds of hybrid varieties that are difficult to keep from harvest by farmers, while seed of self-pollinated crops like legumes is considered less profitable (Rubyogo*etal.,* 2010). .Since government institutions lack capacity to produce seed in sufficient quantities, the role of the informal sector in seed production and

distribution is widely recognized (Sperling and Cooper 2003; Aw-Hassana*et al.,* 2008). The informal sector has great contribution in Ethiopia.

The informal sector distributes seed through many ways that vary from seed-to-seed exchange, gifts, in the form of labour payment or cash sale. Literatures indicate that farmer-to-farmer seed marketing has gained importance as a means of seed exchange in Sub-Saharan Africa (Aw-Hassana*et al.,* 2008; Sperling and McGuire, 2010).

Limited availability of and access to quality seed is often regarded as one of the main obstacles for increasing production and productivity levels of crops (Katungi*et al* 2011). On the one hand, the formal seed sector in Ethiopia focuses mainly on hybrid maize and some cereal crops like bread wheat and tef. On the other hand, smallholder farmers rely on their own saved seed and local informal market to grow legumes including chick pea and most cereals like malt barley since they have been ignored by the formal seed sector. Although many new improved varieties have been developed with a potential to drastically improve production, farmers are still not aware of and are hence not using them due to the weak and even non-existence seed system on chick pea and malt barley.

To fill this gap, Adet Agricultural Research Center promoted chick pea and malt barley community based seed production and distribution scheme on farmers' field in Amhara Region, Ethiopia for the last two to three years. Therefore, this research was initiated to evaluate the profitability of this community based seed production and distribution scheme on farmer's condition for future research and development intervention. It is known that, the effectiveness of community based seed production and distributing of new chick pea and malt barley varieties will depend on the financial profitability of the seed system promoted. Although community based seed production and dissemination was and is being promoted as a means of accelerating the diffusion of new varieties and to create seed access for chick pea and malt barley, the profitability of community based chick pea and malt barley seed production has not been evaluated based on farmers condition. Hence, this study was conducted to assess the costs and benefits of community based seed production system in Amhara Region, Ethiopia whether it was profitable or not and used as bench mark for future promotion. The main objective of the study was assess the profitability of malt barley and chick pea community based seed production and distribution scheme at intervention areas of Lay-Gaint, Farta, Guagusa-Shikudad and Estie woredas for malt barley and Enemay, Yilmana-Densa and Enarj-Enawugaworedas for chick in Amhara Region, Ethiopia.

Materials and Methods

Description of the study areas

Community based seed production and dissemination system was promoted at Lay-Gaint, Farta, Guagusa-Shikudad and Estieworedas for malt barley (Fig. 1) and Enemaw, Yilmana-Densa and Enarj-Enawugaworedas (Fig. 2) for chick pea by Adet Agricultural Research Center with financial and technical support of USAID-ICARDA-Malt barley and chick pea projects. Brief description of the study woredas for malt barley (Table 1) and chick pea (Table 2) is given below.

Table 1: Description of the study areas for malt barley crop in Amhara Region

Characteristics	Woredas			
	Lay Gayint	**Farta**	**Guagusa-Shikudad**	**Estie**
Geographical Location	11°32'-12°16'N latitude to 38°12'-38°19'E longitude	latitude and longitude of 11°51′N and 38°1′E	11°91'-11°92'N latitude to 38°61'-38°87'E longitude	11°37'-11°63'N latitude to 38°06'-38°4'E longitude
Agro-ecology	45.35% highland, 39.43% midland, 12.5% lowland and 2.72%alpine (*wurch*).	25% lowland, 45% midland and 30% highland	70% midland (*Woinadega*) and 30% high land (*Dega*)	6% lowland, 27% midland 27% and 66% highland
Altitude (masl)	1500 to 4235	2,706 (mean)	2562 to 2718	2615 (mean)
Rainfall (mm)	1020 (mean)	1250-1599	1140 to 3572	1300 - 1500
Temperature (^{O}C)	6.9 to 21.9	9 min & 25 max	10 to 25	8 to 25
Soil type	55 % brown, 15% red, 15% black, 10% grey (%) and 5% others in colour	Nitosol is the dominant soil	Nitosol is the dominant soil	Nitosol is the dominant soil type
Distance from regional town (km)	174	102	129	110
Main crops grown	Potato, barley, tef, wheat, triticale, faba bean and field pea	barley, potato, tef, wheat, triticale, faba bean and field pea	Barley, potato, maize, field pea and faba bean	Tef, barley, potato, wheat and chick pea

Sources: LGWAO, 2016; FWAO, 2016; GSAO, 2016; EWAO, 2016

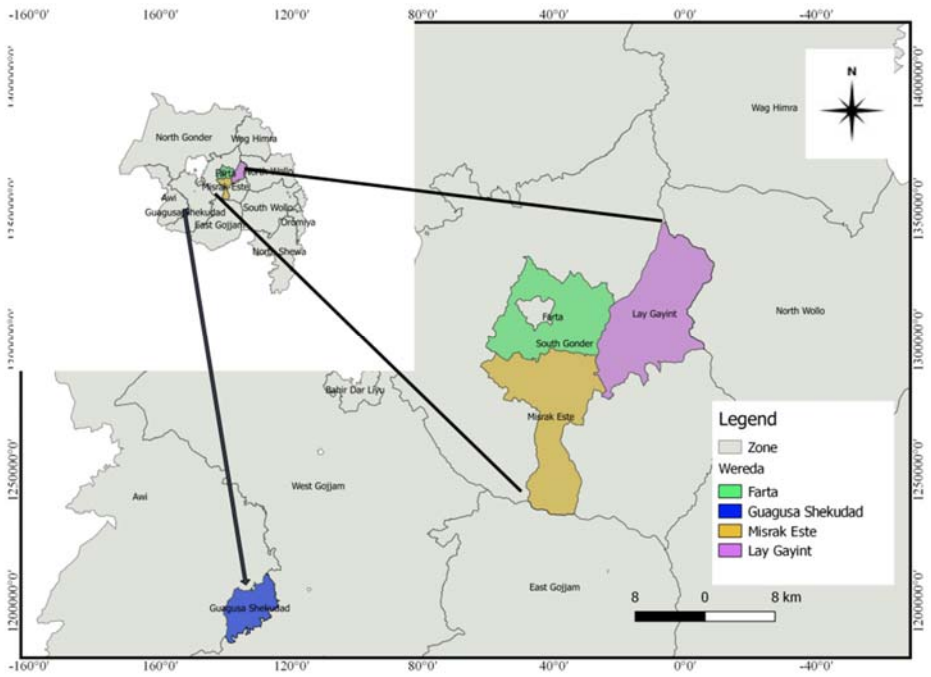

Figure 1: Map of Malt barley community based seed production intervention *woredas* in Amhara Region

Table 2. Description of the study areas for Chick pea crop in Amhara Region

Characteristics	Woredas		
	Enemay	Yilmana-Densa	Enarj-Enawuga
Geographical Location	between 10° 39' 59.99" N latitude and 38° 00' 0.00" E longitude	11°16′N latitude and 38°29′E longitude	6°52′N35°31′E
Agro-ecology	88% midland, 7% highland and 5% lowland; with 50% plain, 40% ragged and 10% mountainous	12% lowland, 64% midland and 24% highland with 56% undulating, 20% mountainous, 8% gorge and 16% plateau	22% lowland (*Kolla*), 50% midland (*Woina-Dega*) and 30% highland (*Dega*) with 50% plain, 30% mountainous, 10.2% gorge and 9.8% undulating
Altitude (masl)	1600 to 3600	1800 to 3200	1100 - 3200
Rainfall (mm)	900-1150	1052-1488	700-2000
Temperature (^{O}C)	21 (mean)	8.8- 25.2	8 - 25
Soil type	75% of land is Vertisol	65% red, 20% black and 15% brown	30% black, 24% brown, 25% red and 21% grey (sandy)
Distance from regional town (km)	290	42	270
Main crops grown	Tef, Barley, Wheat, Maize, Sorghum, Chickpea, Grass pea, Faba bean and Field pea	teff, bread wheat, maize, barley, potato, chick pea, faba bean, field pea, finger millet	tef, barley, wheat, chick pea, grass pea, faba bean and field pea

Sources: EWOA, 2016; YDWOA, 2016; EEWOA, 2016

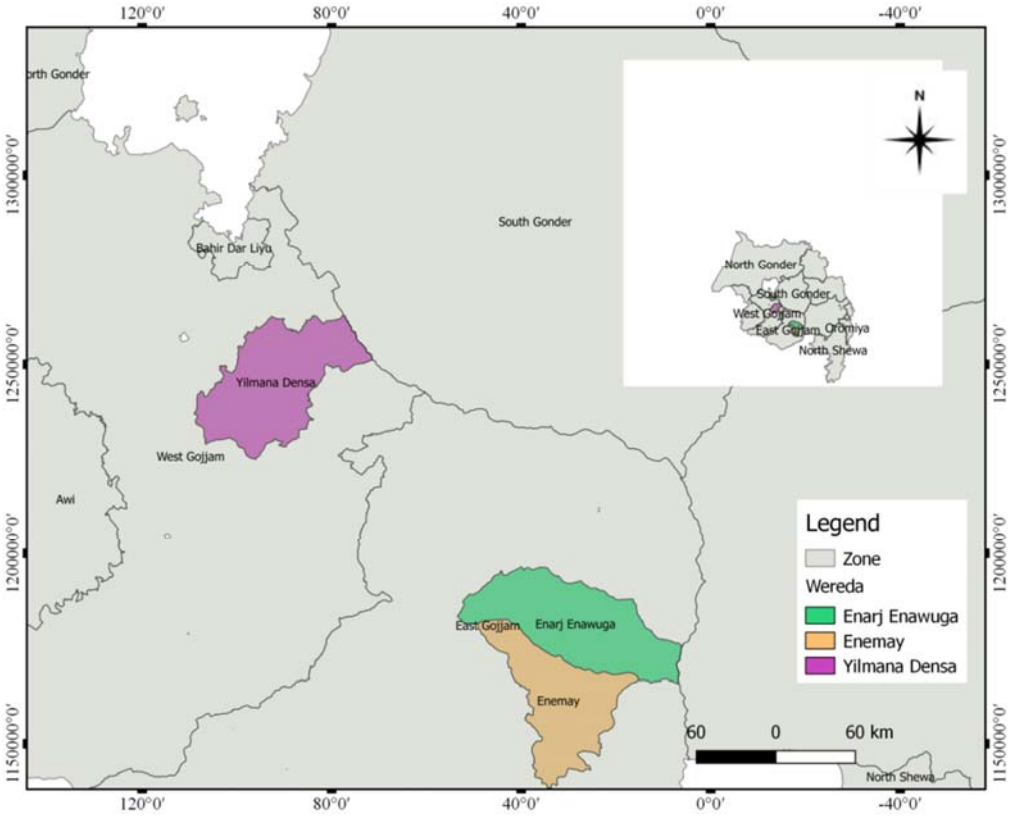

Figure 2: Map of chick pea community based seed production intervention *woredas* in Amhara Region

Agronomic practices (Technology packages) used

The agronomic practices used on the implementation of community based seed production scheme of malt barley and chick pea were recommendations made by the research institutions including Adet Agricultural Research Center and USAID-ICARDA-Malt barley and chick pea projects. The agronomic practices which have been applied on community based seed production were described in brief as below.

Chick pea: Arerti improved chick pea variety was used for the community based seed production activity throughout all locations. A seed rate of 120 kg/ha with fertilizer rate of 100 kg/ha DAP and/or NPS (Nitrogen, Phosphorous and Sulphur) was used. All DAP or NPS was applied during planting. The Bio-fertilizer (inoculants) used was MBI-CP EAL-029 strain mostly bought from Menagesha BioTech private company in Ethiopia based on a rate of 500gm/ha. Famers who have 0.125 to 0.75 hectares of land and are willing to participate were engaged in the community based seed production activity based on land clustering approach.

Malt barley: IBON-174/03, EH-1847 and Sabini improved malt barley varieties were used for the community based seed production activity in the intervention areas. A seed rate of 125 kg/ha with fertilizer rate of 121 kg/ha DAP (Die-ammonium Phosphate) or NPS (Nitrogen-Phosphorous-Sulfur) and 40kg/ha UREA was used for the activity. All DAP or NPS was applied during planting while UREA was applied after 30 days of planting (during 1st weeding). A row planting method with spacing of 20 cm between rows drilling seeds on rows was used.

Data types and method of analysis

The study used a mix of qualitative and quantitative data collected from both primary and secondary sources. Quantitative data like crop yield (grain and biomass/straw) was collected by taking quadrant plot sampling technique on host farmers' field who implemented the activity using a properly prepared data sheet. Detailed information was collected on all the variable production costs incurred from land preparation to harvesting and post-harvest handling as well as materials used in seed production processes. Market prices for chick pea and malt barley seed selling were collected from farmers, traders and marketplaces. Production costs (labour and input) and market prices for output do vary across experimental sites so that pooled data was used for the analysis.

The qualitative (farmers and experts opinions, perceptions and feed backs) data were collected through participatory approaches such as focus group discussions (FGDs), key informant interviews (KIIs) and direct field observations with open-ended interview guidelinesto implement the study and triangulation purposes (to control the quality of data).

Data was analyzed using descriptive statistics (mean and percentages) and social data (farmers' and experts opinion/feedbacks) was simply qualitatively described and classified by themes and contents. Cost-benefit analysis was used to determine the profitability of community based seed productions system. All the input, output and production cost data collected were used in the calculation of the profits (defined as the residual after variable production costs are deducted from the total revenue of seed production activities). Enterprise budgeting method was

followed and net returns analysis was used to determine the level of chick pea and malt barley community based seed production profitability.

To determine the cost and returns of chick pea and malt barley community based seed production, the gross margin (GM) analysis was employed. The gross margin is the difference between the total revenue (TR) and the average total variable cost (TVC). The total revenue is the product of chick pea or malt barley seed quantity in tone (t)/ha and its price per ton. The total cost is given by sum of the total fixed cost (TFC) and the TVC (Katungi*et al*., 2011). Gross margin analysis could be mathematically stated as:

$$GM = GR - TVR \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where GM = Gross Margin Ethiopian Birr/ha,

GR = Average Gross Return/ha, and

TVC= Total Variable Costs (Birr/ha).

Moreover, benefit-cost ratio (BCR) was used to determine the profitability of the community based seed production as stated below:

$$\textbf{Benefit} - \textbf{Cost Ratio} = \frac{\boldsymbol{Total\ Revenue\ (TR)}}{\boldsymbol{Total\ Cost\ (TC)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{2}$$

If BCR > 1, then the total revenue is greater than the total cost; if BCR = 1 then the total revenue is equal to the total cost and if BCR < 1 then the revenue is less than the total cost.

Results and Discussion

Costs of community based chick pea and malt barley seed production

The major variable costs of community based seed production at smallholders' farmers' level could be majorly divided into inputs (materials) and field operational costs. The average total variable costs of community based seed production were 11,383.75 and 16,638.80 Ethiopian Birr (ETB) for chick pea and malt barley crops respectively (Table 3 and Table 4). Among average total cost, average input (material) costs account about 42.5% for chick pea and 31.7% for malt barley while field operation costs account about 57.5% for chick pea and 68.3% for malt barley.

Most of the farmers used family labour in the production process of both crops so that monetary value of wage rate that prevails in the locality was attached to the man-days spent by the family to account for the cost of labour. Out of average total variable cost, seed constitutes the major input cost component (26.35% for chick pea and 16.15% for malt barley) while land preparation and plowing takes the largest among operational costs (almost 23% for both crops) (Table 3). Bio-fertilizer (inoculant) was applied instead of urea fertilizer for chick pea so that urea is not part of input cost for this crop. Weeding cost is minimal for chick pea since it wassown in residual moisture that reduces weed infestation. Next to land preparation, harvesting, threshing and weeding for chick pea and weeding, threshing and harvesting for malt barley are major operational cost components in the order of importance.

Table 3: Estimated average variable costs (in Ethiopian Birr) of community based chick pea production in (Insert the Woredas' name here)Amhara Region, Ethiopia, 2017/18.

Description/type of field operation	Measurement Unit	Units required per ha	Unit Cost (ETB*)	Total cost (ETB/ha)	% of total cost
Cost of inputs/materials				***4,837.50***	***42.49***
Seed	kg	120.00	25.00	3,000.00	26.35
Fertilizer: DAP	kg	100.00	14.80	1,480.00	13.00
Bio-fertilizer	kg	0.50	320.00	160.00	1.41
Bags/Sacks	Number	19.75	10.00	197.50	1.73
Cost of field operation				***6,546.25***	***57.51***
Land preparation and plowing	Man days	12	225.00	2,700.00	23.72
Planting	Man days	4	56.25	225.00	1.98
Fertilizer application	Man days	2	56.25	112.50	0.99
Weeding	Man days	8	72.50	580.00	5.09
Rouging	Man days	4	72.50	290.00	2.55
Plant protection	Man days	2	72.50	145.00	1.27
Harvesting and pilling	Man days	20	71.25	1,425.00	12.52
Threshing	Man days	10	71.25	712.50	6.26
Bagging and transporting	Man days	5	71.25	356.25	3.13
Average total variable cost				***11,383.75***	***100.00***

***ETB=** Ethiopian Birr (Currency)

Table 4: Estimated average variable costs (Eth. Birr) of community based malt barley production in Amhara Region, Ethiopia, 2017/18.

Description/type of field operation	Measurement Unit	Units required per ha	Unit Cost (ETB)	Total cost (ETB/ha)	% of total cost
Cost of inputs/materials				***5,278.80***	***31.73***
Seed	kg	125.00	21.50	2,687.50	16.15
Fertilizer: DAP	kg	121.00	14.60	1,766.60	10.62
UREA	kg	40.00	14.12	564.80	3.39
Bags/Sacks	Number	25.99	10.00	259.90	1.56
Cost of field operation				***11,360.00***	***68.27***
Land preparation and plowing	Man days	18	215.00	3,870.00	23.26
Planting	Man days	12	60.00	720.00	4.33
Fertilizer application	Man days	2	60.00	120.00	0.72
Weeding	Man days	40	70.00	2,800.00	16.83
Rouging	Man days	4	70.00	280.00	1.68
Harvesting and pilling	Man days	22	70.00	1,540.00	9.26
Threshing	Man days	24	70.00	1,680.00	10.10
Bagging and transporting	Man days	5	70.00	350.00	2.10
Average total variable cost				***16,638.80***	***100.00***

***ETB=** Ethiopian Birr

Revenue from community based chick pea and malt barley seed production enterprise

Revenue from community based chick pea and malt barley seed production mainly comes from seed yield and straw yield. The average chick pea seed yield obtained was 1925 kg/ha while it was 2549 kg/ha for malt barley (Table 5). The national and regional chick pea seed yields were 1.899 ton/ha and 1.73ton/ha and that of malt barley were 2.039 ton/ha and 1.831 ton/ha, respectively (CSA, 2016).The chick pea straw yield obtained was 19 bundles/ha while it was 38 bundles/ha for malt barley. The selling price was recorded immediately after harvest at farm gate and the average selling price of seed was 22.8 and 21.5 ETB/kg for chick pea and malt barley respectively while it was 215 ETB/bundle for chick pea and 180 ETB/bundle for malt barley straw yield.

Revenue from community seed production was computed as the total value of seed yield and straw yield so that farmers who engaged in chick pea community based seed production earned a mean gross return of 47,975 ETB per ha (43,890 from seed grain and 4,085 from straw/biomass) while it was 61,643.5 ETB per ha (54,803.5 from seed grain and 6,840 from straw/biomass) for malt barley seed grower farmers (Table 4).

Table 5: Chick pea and malt barley seed yield harvested, average unit price and revenue in Amhara Region, Ethiopia, 2017/18.

Variable description	Unit	Total yield obtained	Unit price (ETB*)	Total revenue
Chick pea				
Total average seed yield harvest	Kg/ha	1925.00	22.80	43,890.00
Straw/Biomass yield of chick pea	Bundle**/ha	19.00	215.00	4,085.00
Total gross revenue (ETB) from chick pea				**47,975.00**
Malt barley				
Total average seed grain yield harvest	Kg/ha	2549.00	21.50	54,803.50
Straw/Biomass yield of malt barley	Bundle/ha	38.00	180.00	6,840.00
Total revenue (ETB) from malt barley				**61,643.50**

***ETB=** Ethiopian Birr (Currency); **Bundle meansone donkey back pack of straw or biomass

Profitability of community based chick pea and malt barley seed production enterprise

Gross margin computed as average total revenue less average total variable cost showed that, a gross return of 36,591.25ETB/ha (76.3% of the total revenue) and 45,004.70 ETB/ha (73% of the total revenue) was earned from chick pea and malt barley community based seed production respectively (Table 6). Moreover, a high benefit-cost ratio value of 4.21 and 3.71 was obtained for chick pea and malt barley, respectively. All these profitability measure results indicate that, farmer based community based chick pea and malt barley seed production are profitable enterprises and are consistent with the findings of Katungi*et al*(2011) on farmer based seed production for common bean in Kenya and Chivatsi*et al* (2002) on the community based seed production of the open pollinated maize in western Kenya.

Table 6: Costs and Returns from community based chick pea and malt barley seed production in Amhara Region, Ethiopia, 2017/18

Variable description	Chick pea	Malt barley	Remark
(1) Total revenue (ETB)	47,975.00	61,643.50	
(2) Average total variable cost (ETB)	11,383.75	16,638.80	
Profitability measures			
(3) Gross Return (ETB): (1)-(2)	36,591.25	45,004.70	
Profit margin/ha (%): (3)/(1)*100	76.3%	73%	
Benefit-cost ratio (BCR): (1)/(2)	4.21	3.71	

***ETB=** Ethiopian Birr (Currency)

Sensitivity analysis of community based chick pea and malt barley seed production

Agricultural production is unpredictable due risk and uncertainties that could happen under natural environment. Therefore, simulation may help to minimize those risk and uncertainties in many cases and sensitivity analysis was done to minimize this. The sensitivity analysis result shows that, chick pea community based seed production enterprises was likely to be more sensitive to yield than to price fluctuations or reductions while that of malt barley responds the same for both price and yield.

A reduction in price of seed grain by 20% reduced the profitability of chick pea by 4.68% and malt barley by 6.74% while 20% yield reduction reduced profitability of chick pea by 5.93% and malt barley by 6.74%. A further 50% reduction in yield reduced the profitability of chick pea by 23.73% and that of malt barley by 26.98% while a 50% reduction in yield reduced coupled with 20% increment in total variable cost (TVC) reduced profitability of chick pea and malt barley by 33.22% and 37.78% respectively (Table 7).The business of community based chick pea and malt barley seed production was found to be profitable over a number of scenarios considered unless extraordinary conditions would happen.

Table 7: Sensitivity analysis of profitability of community based chick pea and malt barley seed production in Amhara Region, Ethiopia, 2017/18.

Item description	Original values	20% reduction in price	20% decrease in yield	20% decrease in yield and 20% increase in TVC	50% decrease in yield	50% decrease in yield and 20% increase in TVC
For chick pea						
Total revenue (ETB)	47,975.00	40,074.80	38,380.0	38,380.0	23,987.5	23,987.5
Average total variable cost (ETB)	11,383.75	11,383.75	11,383.8	13,660.5	11,383.8	13,660.5
Profitability measures						
Gross Return (ETB): (1)-(2)	36,591.25	28,691.05	26,996.3	24,719.5	12,603.8	10,327.0
Profit margin/ha (%): (3)/(1)*100	76.27	71.59	70.34	64.41	52.54	43.05
Benefit-cost ratio (BCR): (1)/(2)	4.21	3.52	3.37	2.81	2.11	1.76
For malt barley						

Total revenue (ETB)	61,643.50	49,314.8	49,314.8	49,314.80	30,821.8	30,821.8
Average total variable cost (ETB)	16,638.80	16,638.8	16,638.8	19,966.56	16,638.8	19,966.6
Profitability measures						
Gross Return (ETB): (1)-(2)	45,004.70	32,676.0	32,676.0	29,348.24	14,183.0	10,855.2
Profit margin/ha (%): (3)/(1)*100	73.0	66.3	66.3	59.5	46.0	35.2
Benefit-cost ratio (BCR): (1)/(2)	3.71	2.96	2.96	2.47	1.85	1.54

***ETB=** Ethiopian Birr (Currency)

Conclusion and Recommendations

Results of this study indicated that producing chick pea and malt barley seed by smallholder farmers in community based seed scheme is a promising and profitable business enterprise in the study areas even under the existing low productivity and/or low price scenario.Chick pea community based seed production enterprises was likely to be more sensitive to yield reduction than to price fluctuations while that of malt barley responds the same for both price and yield. In general, the present study suggests that, this kind of chick pea and malt barley community based seed production can be replicated in other similar areas by grouping and empowering farmers to meet the demand for seeds of improved varieties in the country since both crops are not multiplied by formal seed enterprises or agencies.

Therefore, farmers' need technical assistance and material backstopping on training, initial seeds, new ideas and varieties, agronomic practices, field selection, isolation methods, field inspection and seed certification, etc. from research centers in collaboration with office of agriculture, farmers' cooperatives and seed enterprises of each respective woredas. Moreover, the study suggests that market linkage among chick pea and malt barley producers and cooperatives as well as government seed producer enterprises should be strengthened more for effectiveness and sustainability of the community based seed production since it is profitable enterprise. In addition, chick pea and malt barley community based seed production scheme should be promoted to a wider scale to reach more farmers and unaddressed similar areas by office of agriculture in collaboration with farmers' cooperative unions and/or universities.

Acknowledgments

Adet Agricultural Research Center of Amhara Agricultural Research Institute (ARARI) in leading the implementation of the activity; USAID-ICARDA-Malt barley and chick pea projects in financing, monitoring and evaluating the activity; and farmers in willingness to accept and implement the technology as well as willing to give information for the success of this study are all highly acknowledged.

Disclosure statement

No potential conflict of interest was reported by the authors

References

Amare Tesfaw(2015). Dynamics of Formal Seed Utilization and Use Intensity: Evidence from Wheat Growers in East Gojjam Province, Northwestern Ethiopia. International Journal of Business and Economics Research. Vol. 4, No. 3, 2015, pp. 86-97.

Aw-hassan A Mazid A and Salahieh H (2008). The role of Informal farmers to farmer seed distribution in diffusion of new barley varieties in Syria. Experimental Agriculture 44:413-431.

Bekele Shiferaw and HailemariamTeklewold (2007). Structure and functioning of chickpea markets in Ethiopia: Evidence based on analyses of value chains linking smallholders and markets. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project Working Paper 6. ILRI (International Livestock Research Institute), Nairobi, Kenya. 63 pp.

Berhane Lakew , Chilot Yirga and Wondimu F, 2016. Malt barley research and development in Ethiopia: opportunities and challenges. In: Dawit A, Eshetu D, Getnet A, Abebe K (eds) *Proceedings of the National Conference on agricultural research for Ethiopian renaissance*. Ethiopian Institute of Agricultural Research, Addis Ababa, pp11–20.

Chivatsi W S, Kamau, GM, Wekesa EN, Diallo, AO and Hugo De Groote (2002). Communitybased maize seed production in Coastal Lowland Kenya. pp. 446-451. In: Friesenvity in the new millennium. Proceedings of the 7th Eastern and Southern Africa Regional Maize Conference, Nairobi, Kenya, 11 - 15 February 2002. Mexico, D. F.: CIMMYT.

CSA (Central Statistical Agency) (2018). Agricultural sample survey, 2017/2018 (2010 E.C.), Volume I, report on area and production of major crops. Addis Ababa, Ethiopia

EWAO (EstieWoreda Agriculture Office) (2016). The Annual Report. Unpublished Office Document. Mekane-Selam, Ethiopia.

EEWOA (Enarj-EnawugaWoreda Office of Agriculture) (2016). Annual report on crop production assessment. Debre-Work, Ethiopia.

EWOA (EnemayWoreda Office of Agriculture) (2016). Annual report on crop production assessment. Bichena, Ethiopia.

FWAO (FartaWoreda Agriculture Office) (2016). The Annual Report. Unpublished Office Document. Debretabour, Ethiopia.

GSAO (Guagusa-Shikudad Agriculture Office), (2016). Annual Report on crop production for 2015. Tilili, Ethiopia.

IFPRI (2010). Pulses Value Chain Potential in Ethiopia: Constraints and opportunities for enhancing exports. *Pulses Diagnostics,* July, 2010, IFPRI, Ethiopia.

Katungi E., Karanja D., Wozemba D., Mutuoki T. and Rubyongo JC. (2011). A Cost-Benefit Analysis of Farmer Based Seed Production for Common Bean in Kenya. African Crop Science Journal 19(4):409-415.

LGWAO (Lay GayintWoreda Agriculture Office) (2016). The Annual Report. Unpublished office Document. Nefas Mewucha, Ethiopia.

Ojiewo CO, Rubyogo JC Wesonga JM, Bishaw Z, Gelalcha, SW, Abang, MM

(2018). Mainstreaming EfficientLegume Seed Systems in Eastern Africa: Challenges, opportunities and contributions towards improved livelihoods.Rome, Food and Agriculture Organization of the United Nations. 72 pp.

Rubyogo, JC, Sperling, L Muthoni, R and Buruchara, R (2010). Bean seed delivery for small farmers in Sub-Saharan Africa: Thepower of partnerships. Society & NaturalResources23 (4):285 – 302.

Setimela PS and P Kosina (2006). Strategies for Strengthening and Scaling up Community-based Seed Production. Mexico, D.F.: CIMMYT.

Sperling L and Cooper HD (2003). Understanding seed systems and seed security. In: Improving the effectiveness and sustainability of seed relief. Proceedings of astakeholders' works. Food and Agriculture Organisation Rome, Italy, 26-28 May 2003.

Sperling L and Mcguire S (2010). Understanding and strengethening informal seed markets. Experimental Agriculture 46:1-18.

YDWOA (Yilmana-DensaWoreda Office of Agriculture) (2016). Annual Report on crop production assessment, Adet, Ethiopia.