



## Yield improvement of cow pea through demonstration of improved variety (Bekur) with improved production technologies in Tanqua-Abergelle and Saharti-Samre Districts, Tigray, Ethiopia

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### ABSTRACT

This demonstration was conducted in 2016/17 production season in two purposively selected major cow pea producing areas namely Hadnet and Nebar-Hadnet kebelles from Tanqua-Abergelle and Saharti-Samre districts, respectively. The major objective of this research was to demonstrate high yielding improved cow pea variety so as to increase productivity of cow pea. The specific objectives were to estimate partial budget analysis and collect farmers' perception on improved cow pea variety versus local cultivar. For this study, 35 sample farmers (18 from Hadnet and 17 from Nebar-Hadnet) kebelles were purposively selected based on their willingness to participate in cow pea demonstration. The average grain yield obtained from the improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (10.61 and 14.06 qt/ha) and (7.17 and 9.1 qt/ha), respectively. These shows 47.9% and 54.5% grain yield increment over the local cultivar, respectively. The average straw yield obtained from the improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (28.64 and 33.38 qt/ha) and (26.58 and 30.35 qt/ha), respectively. These shows 7.8% and 9.9% straw yield increment over the local cultivar, respectively. The average gross income generated from grain and straw yield of improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (14,045.04 and 17,079.98 ETB/ha) and (9,642.84 and 11,075.79 ETB/ha), respectively. These shows 45.7% and 54.2% gross income increment over the local cultivar, respectively. The partial budget analysis results indicate that improved cow pea technology was highly profitable compared to local cultivar in both kebelles/locations. Based on farmers' perception analysis result, except the attribute of straw yield, most of the respondents had favored the improved cow pea variety (Bekur) in its grain yield, maturity, pods per plant, seeds per pod, seed uniformity, seed color, marketability, pests resistance, taste of food and time of cooking than the local cultivar (Adengur). Hence, farmers should produce high yielding and early maturing improved cowpea variety that can generated more income instead of producing low yielding, late maturing and less income generating local cow pea cultivar. Besides, further popularization and scaling out of the improved cow pea variety (Bekur) in a similar agro-ecology should be done by the research center and office of agriculture and rural development of the respective districts.

**Key words:** Cultivar, demonstration, gross income, improved, partial budget analysis

## INTRODUCTION

Cow pea (*Vigna unguiculata*) belongs to the family Leguminaceae. It is an important grain legume in drier regions and marginal areas of the tropics and sub-tropics. It is particularly important in West Africa with annual production of over 9.3 million tons (Ortiz, 1998). The grains are good source of human protein, while the haulms are valuable source of livestock protein (Dereje *et al.*, 1995 and Fatokum, 2002).

Cow pea is an important food for human beings; they also provide feed, forage, hay, and silage for livestock, and green manure and cover crops for maintaining the productivity of soils. Non-viable seeds may be ground into meal or flour which is used in a number of ways. The fresh seeds and immature pods are eaten as vegetables (Onwueme and Sinha, 1991). Cowpea is a principal food legume of many African countries where the tender leaves and pods as well as grain are consumed. It is important crops in the semi-arid regions of many African countries including Ethiopia. Cowpea can with stand heat better than most grain legumes and is drought resistant.

Tanqua-Abergelle district is part of the dry low land areas of Tigray region. The rain fall status of the study area is erratic in intensity and uneven in distribution. Moreover the duration is very short. As a result crops are frequently exposed to moisture stress at critical stages of growth which resulted in either low yield or total crop failure.

Cow pea is a major legume crop in Tanqua-Abergelle. It is commonly cultivated by several farmers for human food. However, its productivity is affected by many factors such as shortages of improved seed supply, erratic and unreliable rain fall, soil fertility degradation and poor agronomic practices. Therefore, the constraints can be addressed by supplying early maturing and high yielding improved cow pea varieties. To solve this constraint, Abergelle Agricultural Research Center (AbARC) has taken the initiative in addressing adaptation trials for two consecutive years (2013/14-2014/15) and tested 6 improved cow pea varieties at Tanqua-Aberregelle district (Mearey research station). Hence, best performing, adaptable and high yielding cow pea varieties were identified. Among the six varieties, (Bekur, Kenkenty, Bole, TVU, White wander trailing (WWT), Black Eye Bean (BEB)

and small seed (local cultivar) tested in the adaptation trial; Bekur was the best performed variety.

From the results of two years combined analysis, Bekur gave the highest average grain yield (14.85 Qt/ha) than Bole (13.57 Qt/ ha), WWT (9.83 Qt/ha), Kenkenty (8.47 Qt/ha), TVU (7.99 Qt/ha), BEB (6.71 Qt/ha) and small seed/local cultivar (7.93 Qt/ha). Besides, Bekur was the best cowpea variety in terms of biomass yield, earliness in maturity and provides significant yield in low rain fall seasons. Therefore, to utilize this research output by the end users, Bekur was advanced from adaptation trial in to demonstration trial.

## 2. Objectives of the Study

The major objective of this research was to demonstrate high yielding improved cow pea variety so as to increase productivity of cow pea. The specific objectives were to estimate partial budget analysis and collect farmers' perception on improved cow pea variety versus local cultivar.

## METHODOLOGY

### Description of the Study Areas

#### *Tanqua-Abergelle District*

The district is located in central zone of Tigray which is 120 Km away from Mekelle. It is located 130 14' 06"N Latitude and 38058'50" E longitudes. It has area coverage of 144,564 ha and the average land holding per house hold is estimated to be 1.84 ha. It is agro-ecologically characterized as hot warm sub-moist low land (SML-4b) below 1500 m.a.s.l, however; altitude ranges between 937-2370 m.a.s.l. The mean annual rainfall and temperature ranges between 400-600 mm and 21-41°C, respectively. It has 20 kebelles of which 19 are rural kebelles. Major soil type of the district is sandy soil followed by clay and clay loam. Mixed farming system is dominantly practiced in the district. Major crops grown in the district are; sorghum, maize and pulses (cowpea, ground nut, sesame). The district is also well known for its large number of livestock resources (sheep and goats) and poultry, (TADOoARD, 2015).

#### *Sehari-Samre District*

Seharti-Samre district is located in South-Eastern zone of Tigray region which is 57 Km away from Mekelle. The district is bordered in the North by Degua-Tembien

district, in the South by Amhara region (Sekota), in the East by Hintalo-Wejerat and Emba-Alaje districts and in the West Tanqua-Abergelle district. It has area coverage of 171,650 ha and the average land holding per house hold is estimated to be 1.84 ha. It is agro-ecologically characterized as Weina-Dega (50%), Kola (47%) and Dega (3%). Altitude ranges between 1470-2370 m.a.s.l. The mean annual rainfall and temperature ranges between 350-700 mm and 20-30<sup>o</sup>c respectively. It has 23 kebelles of which 2 kebelles are town (Samre and Gijet). Major soil type of the district is sandy soil followed by clay and clay loam. Mixed farming system is dominantly practiced in the district. Major crops grown in the district are; sorghum, maize, cowpea, sesame, etc. The district is also well known for its large number of livestock resources (goats, cattle and poultry), (SSDOoARD, 2015).

#### **Sampling Technique, Sample Size and Implementation Procedure**

This demonstration was conducted in 2016/17 production season in two purposively selected major cow pea producing areas namely Hadnet and Nebar-Hadnet kebelles from Tanqau-Abergelle and Saharti-Samre districts, respectively. In collaboration with the above mentioned districts office of agriculture and rural development experts and development agents, totally 35 sample farmers (18 from Hadnet and 17 from Nebar-Hadnet) kebelles were purposively selected based on their willingness to participate in cow pea demonstration.

Before execution of the demonstration, farmers and Development Agents (DAs) were trained about the improved cow pea variety and agronomic practices such as recommended seed rate, fertilizer rate, planting dates, etc. Accordingly, farmers were advised to apply the recommended seed rate of 70 kg/ha, fertilizer rate of 100 kg/ha DAP and the seeds were sown in rows with a spacing of 40cm and 10cm between row and plants, respectively. To implement the demonstration, each farmer was hosted 20m\*20m or 0.04 ha of land for the improved cow pea variety and local cultivar for side-by-side comparison. A total of 98 Kg of improved seeds were supplied by the research center but the local cultivar cow pea small seeds locally known as 'Adengur' were used from their own. The total area covered by improved variety was 1.4 ha.

#### **Stakeholders Analysis**

Farmers, staffs of the Office of Agricultural Rural Development (OoARD) and researchers were the main actors in the improved cow pea demonstration. The roles and responsibilities of farmers were hosting land, plowing, sowing, weeding, harvesting, threshing, strict follow up of their plots, etc, OoARD was responsible in rapport building, identifying sample farmers and frequent follow up while researchers' roles and responsibilities were to deliver training and providing technical backstopping to hosting farmers.

#### **Types, Sources and Method of Data Collection**

The study was based on primary and secondary data collected. Quantitative type of data (grain and straw yield data were taken from 35 farmers using quadrant (1m\*1m) and prices of seed grains and biomass were collected from the possible nearby markets using checklist. Similarly, qualitative type of data (households' demography and farmers' perception) were collected from primary sources using semi-structured interview schedule. Secondary data were also reviewed from annual reports, proceedings and journals.

#### **Method of Data Analysis**

To describe the demographic characteristics of hosting farmers, farmers' perception, grain and straw yield, seed and straw price, gross income and partial budget analysis; descriptive statistics was used. The descriptive methods of data analysis used were frequency, percent, minimum, maximum, mean and standard deviation. Independent samples t-test was used to compare mean difference. The data were analyzed using statistical tool (IBM SPSS statistics version 20.0) and Microsoft Excel 2010 for the partial budget analysis.

Partial budgeting analysis was used to determine the level of profitability of improved haricot bean technology over the local cultivar. The success of partial budgeting depends on prediction accuracy, which depends on the accuracy of the information and estimates it contains. Partial budget crystallizes ultimately into the statement of costs and returns based on input and output data. Another technique which is commonly used in measuring the profitability of the new technology over the local one is the marginal rate of return (MRR). It measures the increase in net income which is generated by each additional unit of cost. In other words, MRR measures the effect on net return of

additional capital invested in a new technology, compared to the present one. It is not necessary to calculate MRR if the new technology costs less than the farmer's present technology, or if the new technology yields a lower benefit than the present one for a comparatively higher cost. When this occurs, the technology is said to be "dominated". According to CIMMYT, (1988), if the calculated MRR is greater than 50%, the new technology is profitable in the study area. The partial budgeting methods adopted for this study is defined as follows:

$$\begin{aligned}
 \text{NB} &= \text{GB} - \text{TC} \dots\dots\dots 1 \\
 \text{MB} &= \text{NBIV} - \text{NBLC} \dots\dots\dots 2 \\
 \text{MC} &= \text{TCIV} - \text{TCIC} \dots\dots\dots 3 \\
 \text{MRR} &= \frac{\text{MB}}{\text{MC}} \times 100\% \dots\dots\dots 4
 \end{aligned}$$

- Where, NB= Net Benefit
- GB= Gross Benefit
- TC= Total cost
- MB= Marginal Benefit
- MC= Marginal cost
- NBIV= Net Benefit of Improved Variety
- NBLC= Net Benefit of Local Cultivar
- TCIV= Total Cost of Improved Variety
- TCLC= Total Cost of Local Cultivar

## RESULTS AND DISCUSSION

### Demographic Characteristics of the Households

The household's age ranges from 25 to 78 years and the average was 48.11±14.88 years. The average family size of the study areas was 5.69±1.39 heads per household and the minimum and maximum family size were 3 and 9 per head, respectively. The average number of male and female members less than 15 years in the household was 1.14±1.19 and 1.03±0.89, respectively.

The average number of male and female members between 15 to 65 years in the household was 1.74±0.12 and 1.6±0.91, respectively. The average number of male members greater than 65 years in the household was 0.14±0.36. The average distance to the nearest market place and extension center from the household homestead took 42.66±32.8 and 21.29±18.8 minutes, respectively. The average farming experience of the households' was 24.43±12.27 years (Table1).

From the overall participated farm households, majority (77.1%) were male while the remaining (22.9%) were female. Majority (42.9%) of the households' education level were illiterate while (20%) of them were grade 1-4, about 17.1% were grade 5-8 and 11.4% religiously educated and the remaining (5.7%) were grade 9-12 and read and write (2.9%). Most of the participated farmers were married (94.3%) and the remaining were widowed (5.7%). All the participated farmers' religion was orthodox (100%). Majority (82.9%) of participated farm households' main occupation was farming while the remaining households' main occupations were farming and trading (8.6%), farming and non-farm (5.7%) and farming and off-farm (2.9%) (Table2).

### Grain and Straw Yield and Income Obtained from Improved Cow Pea Variety versus Local Cultivar

Mean comparison of grain and straw yield and income obtained from improved cow pea variety (Bekur) versus local cultivar (Adengur) at Hadnet kebele are described in (Table3). The average grain yield obtained from the improved cow pea variety and local cultivar were (10.61 and 7.17 qt/ha), respectively. This result indicates that there was significant difference in grain yield obtained at p<0.05 between the improved cow pea variety and local cultivar, implying higher grain yield was obtained from the improved cow pea variety compared to the local cultivar.

**Table1: Descriptive statistical results of households' demographic characteristics**

Variable	Min	Max.	Mean	SD
Age of the respondent (in years)	25	78	48.11	14.88
Family size of the respondent (head count)	3	9	5.69	1.39
Number of male < 15 years	0	4	1.14	1.19
Number of female <15 years	0	3	1.03	.89
Number of male b/n 15 to 65 years	0	4	1.74	1.12
Number of female b/n 15 to 65 years	1	4	1.60	.91
Number of male > 65 years	0	1	.14	.36
Distance to the nearest market place (in minutes)	10	120	42.66	32.80
Distance to the nearest extension center (in minutes)	10	120	21.29	18.80
Farming experience (in years)	5	48	24.43	12.27

**Table 2:** Proportion of households' sex, education level, marital status, religion and main occupation

Variable	Frequency	Proportion (%)
Sex of the household head		
Male	27	77.1
Female	8	22.9
Education level of the household head		
Illiterate	15	42.9
Read and write	1	2.9
Religious education	4	11.4
Grade 1-4	7	20.0
Grade 5-8	6	17.1
Grade 9-12	2	5.7
Marital status of the household head		
Married	33	94.3
Widowed	2	5.7
Religion of the household head		
Orthodox	35	100
Main occupation of the household head		
Farming	29	82.8
Farming and off-farm	1	2.9
Farming and non-farm	2	5.7
Farming and trading	3	8.6

**Table 3:** Mean comparison of grain and straw yield and income obtained from improved cow pea variety (Bekur) versus local cultivar (Adengur) at Hadnet kebele

Parameters	Variety	Min.	Max.	Mean	SD	Sig. (2-tailed)
Grain yield (qt/ha)	Bekur	8.49	12.60	10.61	1.29	0.000
	Adengur	5.85	8.69	7.17	0.98	
Straw yield (qt/ha)	Bekur	23.85	35.94	28.64	4.12	0.215
	Adengur	22.10	30.00	26.58	2.45	
Income obtained from grain yield (ETB <sup>1</sup> /ha)	Bekur	8487.00	12600.00	10608.00	1293.12	0.000
	Adengur	5265.00	7824.60	6453.00	880.24	
Income obtained from straw yield (ETB/ha)	Bekur	2862.00	4312.44	3437.04	493.69	0.215
	Adengur	2652.48	3599.64	3189.84	293.72	
Gross income obtained from grain and straw yield (ETB/ha)	Bekur	12770.64	15462.00	14045.04	1065.84	0.000
	Adengur	8426.16	11148.30	9642.84	966.19	

1=Ethiopian Birr (ETB) which is the Ethiopian Currency; SD=Standard Deviation Source: Computed from survey data (2016)

The average income generated from the grain yield of improved cow pea variety and local cultivar were (10,608.00 and 6,453.00 Ethiopian Birr (ETB/ha), respectively. This result indicates that there was significant difference in income generated from grain yield at  $p < 0.05$  between the improved cow pea variety and local cultivar, implying higher income was generated from grain yield of the improved cow pea variety compared to the local cultivar.

The average gross income generated from grain and straw yield of improved cow pea variety and local cultivar were (14,045.04 and 9,642.84 ETB/ha),

respectively. This result indicates that there was significant difference in gross income generated from grain and straw yield at  $p < 0.05$  between the improved cow pea variety and local cultivar, implying higher gross income was generated from grain and straw yield of the improved cow pea variety compared to the local cultivar.

Mean comparison of grain and straw yield and income obtained from improved cow pea variety (Bekur) versus local cultivar (Adengur) at Nebar-Hadnet kebele are described in (Table4). The average grain yield obtained from the improved cow pea variety and local

cultivar were (14.06 and 9.10 qt/ha), respectively. This result indicates that there was significant difference in grain yield obtained at  $p < 0.05$  between the improved cow pea variety and local cultivar, implying higher grain yield was obtained from the improved cow pea variety compared to the local cultivar.

The average income generated from grain yield of the improved cow pea variety and local cultivar were (13,358.90 and 7,737.02 ETB/ha), respectively. This result indicates that there was significant difference in income generated from grain yield at  $p < 0.05$  between the improved cow pea variety and local cultivar, implying higher income was generated from the improved cow pea variety compared to the local cultivar.

The average gross income generated from grain and straw yield of the improved cow pea variety and local cultivar were (17,079.98 and 11,075.79 ETB/ha), respectively. This result indicates that there was significant difference in gross income generated from grain and straw yield at  $p < 0.05$  between the improved cowpea variety and local cultivar, implying higher gross income was generated from the improved cowpea variety compared to the local cultivar.

#### Profitability or Cost Benefit Analysis (CBA) of Improved Cow Pea Technology

Partial budgeting analysis was used to determine the level of profitability of improved cow pea technology over the local cultivar. It was carried out according to (CIMMYT, 1988) methodology. Obviously the yields of both cow pea crop would be realized in a one year period, and therefore, the plan is designed to show only a per annum profile of the cost and returns that vary for

the improved cow pea variety and local cow pea cultivar. The partial budgets omit the fixed costs such as land because it is unchanging across practices. Therefore, partial budget analysis focus only on the variable costs that varied across the practices. This variable cost includes cost of seed, fertilizer, ploughing (land preparation), seed sowing, fertilizer application, weeding, pesticide, pesticide application, harvesting and threshing. All benefits and costs were calculated using the possible nearby market prices. That is, the actual price which the farmer pays for the inputs or receives for his products.

Hence, the respondents were asked to quantify the amount of labor they put on major activities of improved and local cow pea production on a hectare of land. Average working hours for all activities was 9 hours per day in all kebelles/locations. In Hadenet kebele, the nearby market prices used for partial budgeting analysis were (28 and 9 ETB/Kg) for the improved cow pea seed and local cow pea cultivar seed respectively at time of planting and labor and ploughing costs were 70 ETB/day/1 person and 200 ETB/0.25 ha. Seed selling price for the improved cow pea was 1000 ETB/qt while for the local cultivar was 900 ETB/qt. Straw selling price both for the improved and local cultivar was 120 ETB/qt. In Nebar-Hadnet kebele, the nearby market prices used for partial budgeting analysis were (28 and 8.5 ETB/Kg) for the improved cow pea seed and local cow pea cultivar seed respectively at time of planting and labor and ploughing costs were 60 ETB/day/1 person and 200 ETB/0.25 ha, respectively. Seed selling price for the improved cow pea was 950 ETB/qt while for the local cultivar was 850 ETB/qt. Straw selling price both for the improved and local cultivar was 110 ETB/qt.

**Table 4:** Mean comparison of grain and straw yield and income obtained from improved cow pea variety (Bekur) versus local cultivar (Adengur) at Nebar-Hadnet kebele

Parameters	Variety	Min.	Max.	Mean	SD	Sig. (2-tailed)
Grain yield (qt/ha)	Bekur	12.51	16.20	14.06	1.41	0.000
	Adengur	7.65	10.40	9.10	0.96	
Straw yield (qt/ha)	Bekur	27.19	41.17	33.83	5.08	0.121
	Adengur	24.80	34.99	30.35	3.33	
Income obtained from grain yield (ETB/ha)	Bekur	11884.50	15390.00	13358.90	1336.71	0.000
	Adengur	6502.50	8843.40	7737.02	814.36	
Income obtained from straw yield (ETB/ha)	Bekur	2990.79	4528.26	3721.08	559.28	0.121
	Adengur	2727.45	3849.12	3338.78	367.05	
Gross income obtained from grain and straw yield (ETB/ha)	Bekur	15431.04	19721.61	17079.98	1475.88	0.000
	Adengur	9229.95	12383.64	11075.79	1094.58	

Source: Computed from survey data (2016); SD=Standard Deviation

**Table 5:** Partial budget analysis results for improved cow pea variety (Bekur) versus local cultivar (Adengur) at Hadnet kebele

S/N	Parameters	Cow pea varieties	
		Bekur	Adengur
1	Average grain yield (qt/ha)	10.61	7.17
2	Grain price (ETB/qt)	1000.00	900.00
3	Benefit from grain (ETB/ha)	10610.00	6453.00
4	Average straw yield (qt/ha)	28.64	26.58
5	Straw price (ETB/qt)	120.00	120.00
6	Benefit from straw (ETB/ha)	3436.80	3189.60
7	Gross benefit (grain and straw) (ETB/ha)	14046.80	9642.60
<b>Variable costs</b>			
8	Seed cost (ETB/ha)	1960.00	630.00
9	Fertilizer cost (DAP) (ETB/ha)	1788.11	1788.11
10	Ploughing cost (ETB/ha)	800.00	800.00
11	Sowing cost (ETB/ha)	437.50	437.50
12	Fertilizer application cost (ETB/ha)	437.50	437.50
13	Weeding cost (ETB/ha)	1750.00	1400.00
14	Pesticide cost (ETB/ha)	55.00	55.00
15	Pesticide application cost (ETB/ha)	280.00	280.00
16	Harvesting cost (ETB/ha)	875.00	630.00
17	Threshing cost (ETB/ha)	560.00	420.00
18	Total variable cost (TVC) (ETB/ha) (sum of 8 to 17)	8943.11	6878.11
<b>Net benefits</b>			
19	Net benefit (ETB/ha) (7-18)	5103.69	2764.49
20	Marginal benefit (ETB)	2339.20	
21	Marginal cost (ETB)	2065.00	
22	MRR=(20/21)*100%	113.28	

Source: Computed from survey data (2016)

#### Partial Budget Analysis of Improved Cow Pea versus Local Cultivar at Hadnet kebele

Partial budget analysis results for improved cow pea variety (Bekur) versus local cultivar (Adengur) at Hadnet kebele is described in (Table5). The total variable costs incurred for improved cow pea and local cultivar were 8,943.11 and 6,878.11 ETB/ha, respectively. The net benefit from improved cow pea production per hectare was 5,103.69 ETB/ha while the net benefit of local cultivar was 2,764.49 ETB/ha. Therefore, the marginal benefit of improved cow pea variety compared to the local cultivar was 2,339.20 Birr/ha. According to marginal rate of return analysis, improved cow pea variety increased the net benefit by 113.3% with additional cost of 2,065.00 ETB/ha over the local cow pea cultivar. This means for each 1 ETB invested in improved cow pea variety, farmers could get additional 1.13 Birr more than what they could get by investing on local cow pea cultivar. This implies that farmers who sown improved cow pea variety get higher marginal benefit as compared to farmers who sown

local cow pea cultivar. In other words, the new cow pea technology is "better" than the local cow pea cultivar in term of generating additional income.

#### Partial Budget Analysis of Improved Cow Pea versus Local Cultivar at Nebar-Hadnet kebele

Partial budget analysis results for improved cow pea variety (Bekur) versus local cultivar (Adengur) at Nebar-Hadnet kebele is described in (Table6). The total variable costs incurred for improved cow pea and local cultivar were 8,353.11 and 6,393.11 ETB/ha respectively. The net benefit from improved cow pea production per hectare was 8,725.19 ETB/ha while the net benefit of local cow pea cultivar was 4,680.39 ETB/ha. Therefore, the marginal benefit of improved cow pea variety compared to the local cultivar was 4,044.00 ETB/ha. According to marginal rate of return analysis, improved cow pea variety increased the net benefit by 206.4% with additional cost of 1,960.00 ETB/ha over the local cow pea cultivar. This means for each 1 ETB invested in improved cow pea variety,

farmers could get additional 2.06 ETB more than what they could get by investing on local cow pea cultivar. This implies that farmers who sown improved cow pea variety get higher marginal benefit as compared to farmers who sown local cow pea cultivar. In other words, the new cow pea technology is "better" than the local cow pea cultivar in term of generating additional income.

#### Farmers' perception results on improved cow pea variety versus local cultivar

Farmers' perception on attributes of improved cow pea variety versus local cultivar is described in (Table7). Farmers' perception were collected from 35 sample farmers on the attributes of grain yield, straw yield, maturity, pods per plant, seeds per pod, seed uniformity, seed color, marketability, drought

resistance, pests resistance, taste of food (quality) and cooking time. Based on farmers' perception analysis result, except the attribute of straw yield, most of the respondents had favored the improved cow pea variety (Bekur) in its grain yield, maturity, pods per plant, seeds per pod, seed uniformity, seed color, marketability, pests resistance, taste of food and time of cooking than the local cultivar (Adengur). However, 60% of the respondents reported that there is no change in drought resistance between the improved cow pea variety and the local cultivar. Some of the respondents had also strongly favored the improved cow pea variety in its grain yield (100%), maturity (100%), pods per plant (100%), seeds per pod (100%), seed uniformity (100%), seed color (65.7%), marketability (82.9%), taste of food (82.9%) and time of cooking (77.1%).

**Table 6:** Partial budget analysis results for improved cow pea variety (Bekur) versus local cultivar (Adengur) at Nebar-Hadnet kebele

SN	Parameters	Cow pea varieties	
		Bekur	Adengur
1	Average grain yield (qt/ha)	14.06	9.10
2	Grain price (ETB/qt)	950.00	850.00
3	Benefit from grain (ETB/ha)	13357.00	7735.00
4	Average straw yield (qt/ha)	33.83	30.35
5	Straw price (ETB/qt)	110.00	110.00
6	Benefit from straw (ETB/ha)	3721.30	3338.50
7	Gross benefit (grain and straw) (ETB/ha)	17078.30	11073.50
Variable costs			
8	Seed cost (ETB/ha)	1960.00	630.00
9	Fertilizer cost (DAP) (ETB/ha)	1788.11	1788.11
10	Ploughing cost (ETB/ha)	800.00	800.00
11	Sowing cost (ETB/ha)	390.00	390.00
12	Fertilizer application cost (ETB/ha)	390.00	390.00
13	Weeding cost (ETB/ha)	1500.00	1200.00
14	Pesticide cost (ETB/ha)	55.00	55.00
15	Pesticide application cost (ETB/ha)	240.00	240.00
16	Harvesting cost (ETB/ha)	750.00	540.00
17	Threshing cost (ETB/ha)	480.00	360.00
18	Total variable cost (TVC) (ETB/ha) (sum of 8 to 17)	8353.11	6393.11
<b>Net benefits</b>			
19	Net benefit (ETB/ha) (7-18)	8725.19	4680.39
20	Marginal benefit (ETB)	4044.80	
21	Marginal cost (ETB)	1960.00	
22	MRR=(20/21)*100%	206.37	

Source: Computed from survey data (2016)

**Table 7:** Farmers' perception on attributes of improved cow pea variety versus local cultivar

S/N	Attributes	Perception levels (Poor=1, No change=2 and Good=3)		
		Poor (%)	No change (%)	Good (%)
1	Grain yield	0	0	100
2	Straw yield	71.4	2.9	25.7
3	Maturity	0	0	100
4	Pods per plant	0	0	100
5	Seeds per pod	0	0	100
6	Seed uniformity	0	0	100
7	Seed color	34.3	0	65.7
8	Marketability	0	17.1	82.9
9	Drought resistance	0	60	40
10	Pests resistance	0	37.1	57.1
11	Taste of food /'nifro' or 'wot'	2.9	14.3	82.9
12	Time of cooking	5.7	17.1	77.1

Source: Computed from survey data (2016)

## CONCLUSIONS

The major objective of this research was to demonstrate high yielding improved cow pea variety so as to increase productivity of cow pea. The specific objectives were to estimate partial budget analysis and collect farmers' perception on improved cow pea variety versus local cultivar. The average grain yield obtained from the improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (10.61 and 14.06 qt/ha) and (7.17 and 9.1 qt/ha), respectively. This shows 47.9% and 54.5% grain yield increment over the local cultivar, respectively, implying higher grain yield was obtained from the improved cow pea variety compared to local cultivar in both kebelles/location. The average straw yield obtained from the improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (28.64 and 33.38 qt/ha) and (26.58 and 30.35 qt/ha), respectively. This shows 7.8% and 9.9% straw yield increment over the local cultivar, respectively implying higher straw yield was obtained from the improved cow pea variety compared to the local cultivar in both kebelles/location. The average gross income generated from grain and straw yield of improved cow pea variety and local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were (14,045.04 and 17,079.98 ETB/ha) and (9,642.84 and 11,075.79 ETB/ha), respectively. This shows 45.7% and 54.2% gross income increment over the local cultivar, respectively, implying higher gross income was generated from grain and straw yield of the improved

cow pea variety compared to the local cultivar. The marginal rate of return (MRR) of the improved cow pea variety over the local cultivar at Hadnet and Nebar-Hadnet kebelles/locations were 113.3% and 206.4%, respectively. The MRR indicates that improved cow pea technology was highly profitable compared to local cultivar. Based on farmers' perception analysis result, except the attribute of straw yield, most of the respondents had favored the improved cow pea variety (Bekur) in its grain yield, maturity, pods per plant, seeds per pod, seed uniformity, seed color, marketability, pests resistance, taste of food and time of cooking than the local cultivar (Adengur).

## Recommendations

Farmers should produce high yielding and early maturing improved cowpea variety that can generated more income instead of producing low yielding, late maturing and less income generating local cow pea cultivar. Besides, further popularization and scaling out of the improved cow pea variety (Bekur) in a similar agro-ecology should be done by the research center and office of agriculture and rural development of the respective districts.

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