

# Profitability of Groundnut Production Under Smallholder Farmers in Metekel Zone North Western Ethiopia

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## Abstract

Groundnut is South America origin introduced in to Ethiopia in 1920s which is now grown over all warm climate low land part of the country and used as staple food and valuable cash crops for millions of smallholder Ethiopian farmers. This research aims to provide farm level evidence that could guide informed production decision making. The research tried to identified and estimated of cost component and profitability of groundnut production under smallholder farmers. Enterprise budget and descriptive statistics methods were used to analyze data collected from field records of 80 selected groundnut producer smallholder farmers from two districts. The descriptive statistics revealed that harvesting and pilling of groundnut takes higher labor share and female labor contribution is almost similar with male labor in groundnut production process. The enterprise budget analysis revealed that sample smallholder farmers earned net gross margin of ETB 15,761.26 per hectare from groundnut production. Moreover the benefit cost ratio 2.29 indicated that for every one ETB incurred cost, farmers could earn a benefit of ETB 2.29. In addition to this, the sensitivity analysis indicated that profitability of groundnut is more sensitive to increasing of input price and decreasing of output price than to decreasing input price and increasing of output price simultaneously. Therefore, this paper concluded that groundnut production in Metekel zone of Benshagul gumuz is profitable enterprise. This paper suggests that variety improvement and market linkage between producers and agro-industries would be enhanced production and profitability of groundnut under smallholder farmers.

**Keywords:** Groundnut, Production, Cost, Enterprise budget analysis, profitability and Sensitivity analysis

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## INTRODUCTION

Groundnut (*Arachis Hypogaea*) is a low land edible oil crop which cultivated near 100 countries, which 90% are developing countries and it uses as staple food and valuable cash crops for millions of households (Pazderka and Emmott, 2010). It is South America origin and introduced in to Eritrea and Ethiopia in 1920s (Haji and Zekeriya, 2016). Groundnut production is one of the most crucial agricultural crop in the world (Taru *et al.*, 2008), adaptability to dry condition, it requires low inputs and makes it suitable crop for tropical and subtropical.

Groundnut is a legume crop which improves soil fertility by fixing atmospheric nitrogen and save fertilizer cost in subsequent crops (Harfe, 2016). This is an option for smallholder farmers who are unable to purchase inorganic fertilizer due to concurrent increment of fertilizer price (Simtowe *et al.*, 2010). In many countries, groundnut used as oil seed, food and animal feeds all over the world which contains digestible protein ( 25 to 34%), cooking oil (44 to 56%), and vitamins like thiamin, riboflavin and niacin. Its cake and haulms (straw stem) are used for livestock feed (Simtowe *et al.*, 2010).

It is South America origin and introduce into Ethiopia in 1920s, which is now grown over all the warm climate low land area of the country (Haji and Zekeriya, 2016). It is mainly grown in eastern Harerghe and Metekel Zone with immense potential in Gamogofa, Illubabor, West Gojam, North Shoa, North and South Wello, East and West Wellega, and Western Tigray (CSA, 2018). According to the CSA report on area and production of crops, more than 521,326 private peasant holding households have been grown groundnut in 80,841.57 hectares of land in the 2017/18 cropping season leading to a total production of well over 1.45 million quintal (CSA, 2018). According to the same report, Oromia region constitutes the largest proportion of groundnut production areas accounting for 63% (328, 283 ha) and Benishangul Gumz is the second largest contributor in terms of ground nut production areas (20,033.19 ha) out of which more than one half (17,558.84 ha) is found in Metekel zone. Metekel zone is one of the potential groundnuts producing zone in Benshagul Gumuz region, which stood first in terms of area cultivated and groundnut production. It is primary in producing and supplying of groundnut to both domestic and export market in the region. During the 2016/17 cropping season, the zone was produced 357,714.46 quintal of groundnut from 17,558.84 ha of cultivated with average yield of 20.37 qt/ha (CSA, 2017).

To boost the groundnut production in Metekel zone, Governments and non-governmental organization have

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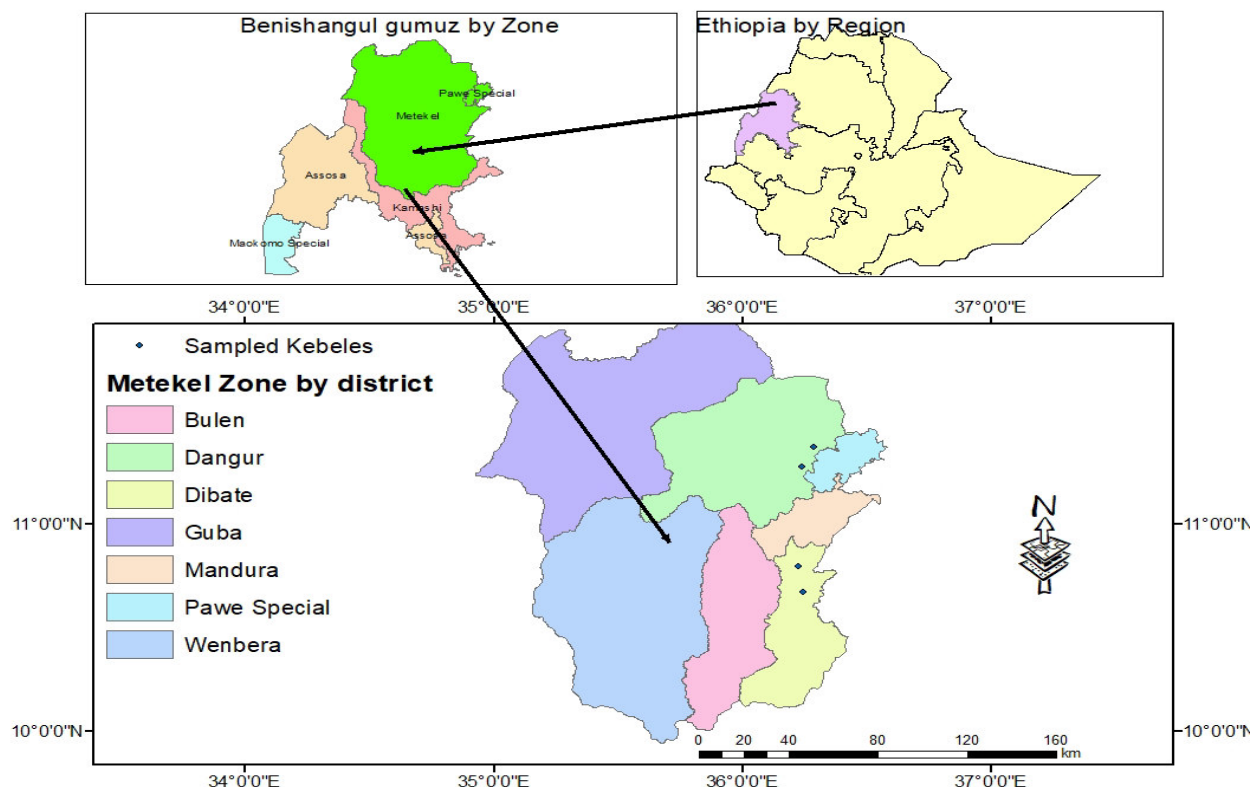
been made tremendous efforts to address the main constraints faced the Groundnut production sector (PARC, 2018). Among the governmental sector Research center takes a lion share on addressing these constraints particularly by innovating new variety that gives high productivity and disease tolerance variety. In line with this Pawe Agricultural research center has been conducted adaptation trials, breeding and demonstration pre scaling and scaling up of Groundnut news variety for the last decades. In collaboration of other research center, it released Maniper varieties and disseminated to end users in Metekel and Awi Zone. These varieties contribute their own role on the smallholder farmers' income increment as well as poverty reduction. Even if, all these efforts has been done the profitability of Groundnut production at household level were not studied yet particularly at Metekel zone. This paper is filled this gap of knowledge and determine the groundnut profitability at household level in Metekel Zone.

## 2. Research Methodology

### 2.1 Description of the study area

The study conducted in Dibate district, Metekel zone Benshangul Gumuz region, North Western Ethiopia. The district is found at 547 Km to North West direction far away from Addis Ababa with geographical location at 36°12'55.57'' longitude and latitude of 10°39'00.48'' It covers an area of 368,289 hectare with estimate population of 67,227 (50.80% male) inhabitants (DDAO, 2018). The farming system of the district is characterized as mixed crop-livestock farming system dominated by cereal and pulses crops. Among the pulses, groundnut takes a lion share in terms of production and area coverage (CSA, 2018). The district is bounded in East by Guangua and Zigem district, in North by Mandura district, in South by Yaso district, in West by Bullen districts. It is characterized as warm humid low land area with high rain fall. The district has 29 kebeles and the climate of the area is hot humid and characterized by unimodal rainfall pattern with high and heavy rainfall that exceeds from May to October. The area receives mean annual rainfall of 1175 mm and its altitude ranges between 1080 to 1700 m with mean annual temperature of 15°C to 29°C which ranges 12°C to 32 °C .

The study conducted in Dangur district, Metekel zone Benshangul Gumuz region, North Western Ethiopia. The district is found at 570 Km to North Western direction far away from Addis Ababa with geographical location at 36°29'46.40'' longitude and latitude of 11°17'03.90''. It covers an area of 838,700 hectare with estimate population of 70,387 (51.13% male) inhabitants (DDAO, 2018). The farming system of the district is characterized as mixed crop-livestock farming system dominated by cereal and pulses crops. Among the pulses, Groundnut takes a lion share in terms of production and area coverage (CSA, 2018). Dangur district is bounded in East by Pawe district, in South by Bullen, in West by Guba districts and in North by Quara and Jawi districts. It is characterized as warm humid low land area with high rain fall. The district has 29 kebeles and out of these kebeles 26 are groundnut producers. The climate of the area is hot humid and characterized by unimodal rainfall pattern with high and heavy rainfall that exceeds from May to October. The area receives mean annual rainfall of 1250 mm and its altitude ranges from 800 to 2731 m.a.s.l with mean annual temperature of 16°C to 38°C which ranges 12°C to 40 °C Dangur district agricultural office (DDAO, 2018).



**Figure 1** Map of the study area

**Data collection and analysis method**

Metekel zone is one of the major groundnuts producing areas in North western of Ethiopia next to eastern of Ethiopia, East and West of Harerge zone. It has six districts that produced groundnut potentially. Among these district, Dibate and Dangur districts were selected randomly. Two kebles from each district and 20 sample households from each kebeles were selected randomly. Accordingly Parezeit and Sasmandin from Dibate district and Abay kutir 2 and Azareti kitli from dangur district was selected.

The study used both primary and secondary data. The primary data were collected using prepared input output recording format developed by the researches and recorded each farming activities and associated costs with the trained extension agents per weekly. It also regularly supervised by the researchers and take measure and correction actions when mistakes of data taking have been happened. The secondary data were collected from Dibate and Dangur district of agricultural office. Descriptive statistics, frequency, percentage, gross margin and sensitivity analysis were used to analysis the data.

To determine the level of groundnut profitability enterprise budgeting methods was employed. It also used gross margin analysis to determine the cost and return of groundnut production in Metekel zone. The gross margin is simply the difference between total revenue (TR) and Average total variable cost (ATVC). Total revenue is the product of output in qt/ha and its price /qt. Total cost is the sum of total fixed and variable costs. This type of model was used by different Authors to calculate the profitability of different crops. (Ayalew *et al.*, 2018) and (Hagos and Bekele, 2018) used enterprise budget and gross margin analysis to calculate the profitability of soybean in Metekel and Asosa zone of Benshangul gumz regional state, Ethiopia respectively. Mathematically

$$\text{Net Gross Margin} = \text{Gross Revenue} - \text{Average Total Cost} \text{ ----- } 1$$

**Break Even Analysis**

Break even analysis is a useful tool in enterprise analysis to determine the profitability of the enterprise even at worst condition. It also used to fix the minimum output sale price and the minimum amount of outputs to be produced to cover all the average total cost of enterprise production costs. The Mathematical formula of break-even analysis is given below

$$\text{Break - Even Sale Price} = \frac{\text{Average Total Cost}}{\text{Average Production(Yield)}} \text{ ----- } 2$$

$$\text{Break – Even Yield} = \frac{\text{Average Total Cost}}{\text{Sale Price}} \text{-----} 3$$

## Result and Discussion

### Demographic characteristics' of sample households'

Most of the sample households were male heads (92.5%) and their educational background was at least attained primary school and above (41.3%) with illiterate of 37.5% and the remains were able to read and write (21.3%).

**Table 1 Sex and Educational background of Sample household heads**

Variables	Frequency	Percent
Sex of HHs		
Male	74	92.5
Female	6	7.5
Total	80	100
Education of HHs		
Illiterate	30	37.5
Read and write	17	21.3
1-4 <sup>th</sup> grade	5	6.3
5-8 <sup>th</sup> grade	18	22.5
9-12 <sup>th</sup> grade	10	12.5
Total	80	100

Source: Farm level survey

### Socio economic characteristics of sample households'

The groundnut producing sample household heads age was on average 43.98 years old with 22.56 and 12.5 of farming and groundnut producing experience in years in the study area. The result indicated that groundnut is introduced in the area recently. The sample survey indicated that on average 0.92 and 1.92 hectare of land was allocated for groundnut and other crop production respectively. It indicated that groundnut crop is very important low land oil crop in the study area. This is due to groundnut is a league crop which needs a least amount of inputs like fertilizer and one or two ploughing frequencies. It is cash crop and main source of income in the study area.

**Table 2 Farming experience and area allocation of Sample households in Metekel zone**

Variables	Mean	Std.deviation	Min	Max
Age of HHs in year	43.98	12.26	22	78
Farming experience in years	22.56	12	1	58
Groundnut farming experience in year	12.5	8.10	1	37
Area allocated for groundnut	0.92	0.52	0.25	2.5
Area allocated for other crops	1.92	1.34	0.25	5.5

Source: Farm level survey

### Sample households' Groundnut production in Metekel zone

Majority of the sample households (56.25%) were cultivated one hectare and above for groundnut production while 43.75% of sample households were cultivated 0.25 to 0.75 hectare of land for groundnut production during the 2018/19 cropping season. Most of them were produced less than 1900 kg per hectare of groundnut yield which is less than the national average groundnut yield per hectare (1796 kg/ha) as well as the Bensgangel Gumuz regional state of groundnut yield 2053 kg/ha ( CSA, 2018).

**Table 3 Distribution of area under groundnut and attained yield by sample households**

Groundnut area(ha)	Frequency	Percent
0.25-0.75	35	43.75
1-1.5	39	48.75
1.75-2.5	6	7.5
Groundnut production(kg)		
252-495	10	12.50
510-924	21	26.25
1,000-1,750	31	38.75
1,900- 3,500	18	22.50

Source: Farm level survey

### Labor allocation of Sample Household on groundnut farming activities

In developing countries, like Ethiopia most of agricultural activities were done through the unskilled human

labor with little combination of modern farm machineries. Groundnut production is among legume crops produced in Ethiopia which takes massive human labor to perform the different farm activities of groundnut. The table below showed that human labor distribution among different Groundnut farming activities disaggregated by sex in north western Ethiopia. According table, Harvesting and piling of groundnut production takes higher labor share (45.60%) among different groundnut farming activities. This is due to groundnut seed is matured underground and harvested using small hand tools by digging of the ground. Groundnut harvesting labor can share more than this, if does not rain during harvesting of groundnut due to drying of the groundnut farm and difficult to digging out of the groundnut seed. Next to harvesting and piling, Hoeing and first weeding(28.73%) was employed higher labor and followed by second weeding(11.69%), planting(8.16%) and land clearing and first plough(5.82%) from the total of 8938 man-days labor used for groundnut farming activities. Female labor is almost participated in all groundnut farming activities which shares (47.09%) even their labor contribution were higher than male farmers in hoeing and first weeding (14.77%), relatively the same and followed by harvesting and piling (22.29%). These groundnut farming activities are relatively labor intensive and mostly accomplished by men and women human labor in the study area.

Table 4 Labor distribution among different groundnut farming activities in Metekel zone

Farming activities	Labor-day		Male %	Female %	Total % share
	Male	Female			
Land clearing and first plough	385	135	4.31	1.51	5.82
Planting	413	316	4.62	3.54	8.16
Hoeing and First weeding	1,248	1,320	13.96	14.77	28.73
Second weeding	599	446	6.70	4.99	11.69
Harvesting and Piling	2,084	1,992	23.32	22.29	45.60
Total	4729	4,209	52.91	47.09	100

Source: Farm level survey

#### Number of paired Oxen day labor used in groundnut farming activities

Groundnut farming in Metekel zone is common and sowing at least with one plough and at most with the second ploughing frequency. According the field level data, on average 5 and 3.82 paired oxen day was used in first ploughing and sowing of groundnut farming activities in Metekel zone.

Table 5 Oxen day used in groundnut farming in Metekel Zone

Farming activities	Paired Oxen per day			
	Mean	Std.dev	Min	Max
First ploughing	5	2	1	10
Sowing	3.82	2.05	1	10

Source: Farm level survey

#### Sample households types of cost incurred in groundnut production

Mixed farming is the base of smallholder farmer livelihood in Metekel zone. They are practicing both livestock rearing and crop production at the same time. Both animal rearing and crop production needs wisely allocation of labor, land, capital and light farm tools. Groundnut is among low land oil crops which potentially produced in Metekel zone. Sample households were combined different inputs to produce groundnut yield. Some of them were human labor, oxen labor, land, seed of groundnut and small farm tools like shovel, hoe and oxen materials. Sample households were combined these inputs and incurred associate farm input costs to produce groundnut yield. Sample households incurred two different types of costs, farm operation and material costs. The farm operation costs share 83.13% from total costs incurred by sample households' in producing of groundnut. Among the farm operation costs harvesting and piling costs takes higher share 23.75% and followed by ploughing cost ( 19.82), hoeing and first weeding (15.35%), second weeding (8.74%)g, Hatchery price (7.62%), planting (3.97) and land clearing(2.5%) respectively. The cost of material was share 16.87% from the total cost incurred by sample households with 14.52% of seed cost and remain 2.35% costs of bags.



Table 6 estimated cost of Groundnut production in Metekel zone

Types costs incurred	Mean	Std.dev	Min	Max	Total share in %
Cost of Material					16.87
Seed cost	1,879.30	938.76	500	4,620	14.52
Bag cost	304.80	188.21	60	840	2.35
Cost of farm operation					83.13
Land clearing	323.22	287.02	30	1,680	2.50
Planting	513.63	368.27	80	2,400	3.97
Ploughing	2,565	1,879.70	400	8,000	19.82
Chemical spring	180	91.15	60	360	1.39
Hoeing and First weeding	1,986.65	1,304.60	140	6,000	15.35
Second weeding	1,131.14	848.94	240	3,600	8.74
Harvesting and piling	3,074.63	1,514.69	780	10,400	23.75
Hatchery price	986.33	628.92	120	3,200	7.62
Total Average cost	12,240.33	5,196.40	3,374	2,4400	100

Source: Farm level survey

### Profitability of groundnut production In Metekel Zone

The sampled households average groundnut yield production was 1306.42 Kg/ha in Metekel zone which is far lower than the maximum yield obtained from improved groundnut variety 6000 kg/ha at research center. This is due to sample households were used local groundnut races, poor agronomic practices and lack of appropriate fertilizer use especially phosphorus fertilizer which used for nodule formation, good seed formation, promote root growth and enhance nutrient and water use efficiency (Harfe, 2016). It obtained 3765.01 kg /ha of groundnut with 20 kg /ha of phosphorus fertilizer application. The sampled households were attained 252 to 3500kg/ha yield of groundnut Due to abiotic, biotic and agronomic practices during 2018/19cropping season. The result indicated that, there is an option to double the yield of groundnut yield per ha at smallholder farmers through adopting of improved groundnut variety and recommended agronomic practices.

On average groundnut yield was sold 20.13 birr/kg with minimum 12 and maximum 23 birr/kg during 2018/19 cropping season. The price fluctuation is mainly due to form of selling, which sold their unshelled groundnut yield at 12 birr/kg and sold shelled groundnut yield at 23 birr/kg especially manually shelled groundnut yield was sold at higher price than shelled by machine. This implies that sample households in the study area can maximize their return of groundnut profit by value adding of their products through hatchery of groundnut either manually or machine which shelled groundnut yield sold at higher price than unshelled groundnut yield.

The gross margin result indicated that groundnut producers in Metekel zone were gained 15,761.26 birr/ha of profit during 2018/19 cropping season. This implies that groundnut production in Metekel zone is a profitable enterprise at smallholder farmer levels within the current productivity level of groundnut and its output price.

Table 7 Profitability of groundnut production under smallholder farmers in Metekel zone

Variable	Mean	Std	Min	Max
Yield	1306.42	754.06	252	3500
Unit price	20.23	3.16	12	23
Gross Revenue	28,001.58	16,821.87	5,200	77,000
Total Fixed cost	1,879.30	938.76	500	4,620
Total Variable cost	10,361.03	4,410.81	2,824	20,400
Total cost	12,240.33	5,196.40	3374	24,400
Net Revenue	15,761.26	12,876.49	-6,268.7)	52,960
CBR	2.29			

Source: Farm level survey

### Break even analysis of groundnut production in Metekel Zone

Break even analysis of an enterprise has an ability to determine the minimum break even sale price of the outputs and break even yield of an enterprises' outputs to continue the enterprise as business institution without profit loss. The groundnut production break even analysis in Metekel zone revealed that, the breakeven sale price of groundnut to cover all total average costs of groundnut production was 9.37 as well as the breakeven yield of groundnut yield was 605.06 kg/ha of groundnut yield to cover all total average cost of groundnut production in the study area. Therefore, smallholder groundnut producers as enterprise managers should be produced at least 605.06kg/ha shelled groundnut yield and set groundnut shelled yield at 9.37 birr/kg and above to save the enterprise from profit losing Table(8).

Table 8 Break even analysis of groundnut production in Metekel Zone

Variable	Mean	Std	Min	Max
Yield	1,306.42	754.06	252	3,500
Unit price	20.23	3.16	12	23
Total cost	12,240.33	5,196.40	3374	24,400

Source: Farm level survey

### Sensitivity analysis of groundnut production in Metekel zone

Agriculture sector is highly sensitive to weather fluctuation especially in developing countries. Ethiopia is one of the developing countries, which its agricultural activities is based on rain fed agriculture. Almost all smallholder farmers, in Ethiopia practice their crop production under rain fed agriculture. Rain fed cropping system is more severe and uncertain to weather fluctuation as well as fluctuated input and output price of agriculture commodities. In addition to this the yields of agricultural commodities is highly affected and depend on the shortage of water faced during different growth stage of the crop. Hence, considering of these factors during planning and implementing of crop enterprise under rain fed agriculture is very important to minimize risk and to show the profitability of the crop production enterprise under fluctuated weather condition and as well as fluctuated input and output agricultural commodity prices'. However, Bad weather condition can be affected the rain fed crop production up to 100% and rain fed based crop enterprise can get loss 100%. Therefore, what is the profitability level and response of groundnut production, if groundnut production input materials and groundnut yield price is increased and decreased simultaneously and the productivity of groundnut being considered as constant? The sensitivity analysis showed that groundnut profitability is decreased by 30% and 55.35%, when the total average cost of groundnut increase by 10 and 20 % and groundnut output price decrease by 10 and 20% respectively. It also showed that groundnut profitability is increased by 19.64% and 44.63%, when the total average cost of groundnut decreased by 10 and 20 % and groundnut output price increased by 10 and 20% respectively. This implies that groundnut enterprise is still profitable at fluctuated input and output price of groundnut yield and it is more sensitive to input price increment and output price decreasing than input price decreasing and output price increasing simultaneously the result is in line with (Hagos and Bekele, 2018).

Table 9 Sensitivity analysis of groundnut production enterprise in Metekel zone when the price of groundnut decrease and Total average cost increase by 10 and 20 at same time, what happen to groundnut profitability

Variables	Baseline output	Mean	std
Profit	15,761.26	15,761.26	12,876.49
Unit price	20.23	20.23	3.16
Yield price decrease by 10%		18.21	2.84
Yield price decrease by 20%		16.19	2.53
Total average cost increase by 10%		13,464.36	5,716.04
Total average cost increase by 20%		14,688.39	6,235.68
Revenue 1		24,441.38	15,596.42
Revenue 2		21,725.67	13,863.48
Profit 1		10,977.02	11,339.17
Profit 2		7,037.28	9,391.50
Profit 1 % change		30.35	
Profit 2 % change		55.35	

Source: Farm level survey

Table 10 Sensitivity analysis of groundnut production enterprise in Metekel zone when the price of groundnut increase and Total average cost decrease by 10 and 20% at same time, what happen to groundnut profitability

Variables	Baseline output	Mean	std
Profit	15,761.26	15,761.26	12,876.49
Unit price	20.23	20.23	3.16
Yield price increase by 10%		22.25	3.48
Yield price increase by 20%		24.28	3.79
Total average cost decrease by 10%		11,016.29	4,676.76
Total average cost decrease by 20%		9,792.26	4,157.12
Revenue 1		29,872.80	19,062.29
Revenue 2		32,588.51	20,795.22
Profit 1		18,856.51	15,423.95
Profit 2		22,796.25	17,516.95
Profit 1 % change		19.64	
Profit 2 % change		44.63	

Source: Farm level survey

## Summary and conclusion

Groundnut is introduced to Metekel zone, Benshangul region during the settlement program in 1985. Groundnut is cash crop and becomes the main income source to smallholder farmers in the study area. It is labor intensive that created job opportunities for smallholder farmers, daily laborer, Assembler, broker, retailer, whole seller and processors. The main objective of this study was to determine the profitability of groundnut enterprise under smallholder farmer level in Metekel zone. To meet its objective, it was taken 80 sample households from Dibate and Dangur district randomly. The majority of the respondents were male headed (92.5%) with educational background of at least attained primary school and above 41.3% and illiteracy rate of 37.5%. Majority of sample households' age were within the productive age with average farming experience and groundnut production experience of 22.56 and 12.5 years respectively. The respondents were allocated 32.39% of cultivated land for groundnut out of their total cultivated land with average 0.92 hectare of groundnut area planted during 2018/19 cropping season that indicates its importance in the district.

Human labor, oxen labor, hoe, land, seed and oxen materials were used in the groundnut production process. Among these, Human labor takes the lion share with 8938 labor days. Female labor participated in all groundnut farming activities and shares 47.09% with greater labor contribution than male in hoeing and first weeding of groundnut farming activities. The groundnut enterprise was expended material and operational costs. Farm operational costs were taken 83.13% out of the total average variable cost. Among farming operation costs, harvesting and piling costs was taken higher share (23.75%) and followed by ploughing (19.82), hoeing and first weeding (15.35), second weeding (8.74%) and hatchery price (7.62%).

The sample households average groundnut production was 1306.42 kg/ha and sold their products with average sale price of 20.23 birr/kg. The production of 1306.42 kg/ha groundnut were expended 12,240.33 birr of total cost on average. Sample households were earned 15,761.26 birr/ha profit at the current productivity and groundnut yield price. The sensitivity analysis indicated that groundnut production more sensitive to input price increase and output price decrease than input price decrease and output price increase simultaneously. It also indicated that, it is even profitable at fluctuated input and output prices that earned 7,037.28 to 22,796.25 birr/ha of profit.

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Some of Groundnut fields in Dangur district



Mr Birhanu's son during hoeing period



Photo was taken during data collection in Dangur district, Benshangul Gumuz Region