

Original Research Article

Food crop production in discourse; a socio economic and biophysical analysis in Mbiame Sub-Division, North West Region, Cameroon

Abstract.

Food crop production has become the main stay of the rural population of Cameroon. This study which focuses on food crop production had as objective to determine the trends and determinants of food crop production in Mbiame, North West Region of Cameroon. The guiding premise was that yields are fluctuating due to changes in socio economic and biophysical environment. To ascertain this, a cause evaluation analysis was undertaken through a farmer participatory approach (with 150 questionnaires) and focus group discussion (Njanawa women's group, mbohnsso maize producers, Rifem common initiative group, Mbohchari farmers group and Ngorin farmers group); who identified the various variables behind the fluctuating yields. An assessment on the trend in yields was carried out to establish whether for the past years food crop has been increasing, decreasing or has remain constant. It was with certainty established that the general trends of yields have been decreasing as follows; soya beans (14.29%), maize (18.57%), groundnut (18.57%), beans (17.14%), cocoyam (8.57%), Irish potato (14.29) and cassava (8.57). It was realized that biophysical parameters (soil infertility, pest and diseases, climate variability, weed and natural disaster (floods and strong winds) and socio economic factors (land tenure system, inadequate farm inputs(seeds, fertilizers, pesticides and herbicides), outdated farm tools, credit facilities and poor state of roads) were the main drivers behind decreasing yields. Farmers were equally confronted by a number of constraints such as; increase population of pest, illiteracy on the part of farmers and farmer-grazer conflicts. Hence, better policy orientations and support programs are required to enhance food crop production in this region.

Keywords; *Biophysical, socio economic, yields, foodcrop, production, North West Region, Cameroon*

Introduction

Food crop production is a major sector that produces food to sustain the rural population. The population of Mbiame has continued to increase thereby putting more pressure on food

Comment [001]: You may reconstruct this title as "Socioeconomic and Biophysical Analyses of Food Crop Production in Mbiame Sub-Division, NorthWest Region, Cameroon"

Comment [002]: You may incorporate this in the next statement, avoid using it as your first sentence. You may state with the main focus of the study with no introduction.

Comment [003]: Use past tense, focused.

Comment [004]: Please, recast or reconstruct this sentence.

Comment [005]: There is no gap in socioeconomic.

Comment [006]: Use past tense, remained.

Comment [007]: Please, recast this phrase.

Comment [008]: Use "It" capitalizing "I".

Comment [009]: Reduce your keywords to maximum of 5.

resources. Agriculture is the single largest contributor to the wellbeing of the rural poor in Cameroon, sustaining 90% of the rural population needs (Nformi, 2001). Yengoh (2012) reiterates that biophysical and socio cultural factors are determinants of food crop production in Cameroon. Cameroon's agro-ecological diversity hosts three main farming systems dominating most of the sub-Saharan African region. These are forest-based, tree-crop based and cereal-root crop-based farming systems (de Graaff et al. 2011). Cameroon therefore has a range of 23 major crops, one of the greatest in Africa (Westphal et al.1985). Most countries around the Sahel and Sudan-Sahel have only about 12 (Westphal et al.1985; de Graaff et al.2011). Nevertheless, all parts of the country do not necessarily provide suitable biophysical conditions for the production of all crops being cultivated. The country's agriculture is rich and varied, but largely under-utilized. The major food crops are tubers (cassava, cocoyam, yam, Irish potato and sweet potato), plantain, cereals (rice, maize, sorghum and millet) and vegetables (beans, cowpeas, groundnuts and soya). Agriculture, apart from plantations, is generally intensive, based on subsistence with the surpluses sold in the markets to purchase other needs (Appraisal Report, 2003).

Food crop production is, by its very nature, a major user of natural resources, although in different ways and to different extents depending on farming system (Tankou *et al*, 2017). Climate is a major determinant in food crop production and Mbiame lies in the humid tropical belt with two distinct seasons: dry and rainy seasons, these two seasons greatly influence the type of food crop cultivated in this area such as maize, Irish potato, beans, soya beans among others. The rainy seasons runs from mid-March to late October which falls in line with the planting season while dry season continues from late October to Mid-March and support only few food crops like beans, soya beans, cassava and Irish potato (Tingem *et al*, 2008). In combination with altitude, slope orientation, temperature inversion, mist and cloud lead to the development of different local climatic zones (Hawkins and Brunt, 1965). Stevenson *et al*, 2011 holds that food crops have continued to perform below its potential due to determining factors like farmers level of education, land tenure systems, credit facilities and climate variability. This is true in many parts of Africa in particular where, with some important exceptions, agricultural productivity has shown only little or no growth. Low rates of agricultural growth combined with high rates of population growth mean that many African countries have gone from being net food exporters to become net food importers.

A key observation of the 2009 International Assessment on Agricultural Science and Technology for Development (IAASTD) is that "agriculture operates within complex social,

Comment [OO10]: Use past tense, reiterated.

economic and environmental systems and so should be seen as multifunctional in its nature". Agriculture's multiple roles which encompass not only food production systems but also issues such as social organization, issues related to access to land, resources and local markets, the continuum between rural and urban environments, cultural identities and local and indigenous knowledge and sustainable tourism call for an integrated approach to enhancing agriculture and food security.

To meet the growing demand for food, biophysical and socio economic determinants need to become more productive and less wasteful (Mohammed, 2011). They need to provide decent incomes for farmers, including the landless and waged agricultural workers, and create employment in the rural areas that respects labour standards. They must be more efficient and more sustainable, in terms of their use of and effects on the natural resource base. They need to be more resilient to shocks and changes, better able to withstand increased climatic shocks and rising temperatures. They have to reduce their levels of GHG emissions. They also have to provide other important ecosystem services, such as water provision, pollination, flood and disease control and maintenance of soil fertility. They need to reduce their dependence on fossil fuels: sustainable agriculture necessarily relies on clean, green, renewable energy and increased energy efficiency. And finally, less produce must be wasted or lost post-harvest. All of these challenges require that food and agricultural systems are made more sustainable, not only from an economic perspective but also from biophysical, social and economic perspectives and at various scales, from the local to the global (Tankou et al, 2017.Yengoh, 2013.)

Comment [OO11]: Give the meaning of the acronym GHG if you have not done that before you can be using it freely.

Comment [OO12]: The objectives of the study should be given at the lower part of the introduction,

1. Materials and methods

Tools of data collection and analysis

Data was collected using primary and secondary sources. Primary data was obtained using field techniques such as direct observation, in -depth interviews with stakeholders, focused-group discussions and household questionnaires. The population of the study comprised the total population of Mbiame Sub Division, which stands at 51000 inhabitants, 13068inhabitants in the urban area and 37,932inhabitants in the rural area. The target population constituted mostly food crop producers who make up more than 80% of the rural population. Considering the ratio 1:250 inhabitants as the base, the sample size was calculated using the formula; Total rural population/Base ($37,932/250 = 150$). The sampling procedure used in this study was stratified random sampling technique in the sense that the

101 population was first categorized according to the activities under consideration and from each
 102 category simple random sampling technique was applied to select the respondents. The 150
 103 questionnaires were distributed as follows;

Villages	Estimated farmers	Number of questionnaires	%
kovki	392	12	18
Njanawa	2000	25	37.5
Mbosong	753	15	22.5
Kovjoh	118	11	16.5
Lam	531	15	22.5
Mbohnso	1000	20	30
Ngorin	689	12	18
Rifem	2000	23	34.5
Mbochari	1050	17	25.5

104

105 Table 1; questionnaire distributed by villages

106 Generally, villages in Mbiame share a lot of common characteristics and share similar
 107 biophysical and socioeconomic problems as far as food crop production is concerned. This
 108 implies that the percentage interviewed may be small compared to the estimated farming
 109 population but the results reflect the entire village. Njanawa, Mbohnso, Rifem, and Mbochari
 110 had the highest number of questionnaires 25,20,23,17 respectively because of their high
 111 farming population and because they still have relatively fertile soils still attracting a lot
 112 farmers from other parts of the Division.

113 The first section of the questionnaire tackles the socio economic characteristics of the
 114 population involve in food crop production like sex distribution, age, marital status, level of
 115 education, occupation, type of agriculture practiced and farming experience relating these
 116 variables to food crop production. In Section two, the questionnaire seeks to identify the
 117 evolution of food crop production and the biophysical and socio economic factors affecting
 118 food crop production. The questions were both opened and closed-ended. We adopted the on-
 119 the-spot method to administer the questionnaires which gave a high respondent rate of 95%.

More so, interviews were conducted with some resource persons such as Mayor of Mbiame Sub Division, Director of CARITAS (family farming school), Government Extension personnel's and project facilitator for CENDEP (Center for Nursery Development and Eru Propagation). This permitted us to get information that was out of the reach of farmers and know what the government and other institutions such as IRAD(Institute for Agricultural Research for Development), ACEFA (Programme for the Improvement of Competitiveness of family Agro-Pastoral Farms) have been doing in the domain of food crop production. Also, five focus groups were organized such as Njanawa women's group, mbohnso maize producers, Rifem common initiative group, Mbohchari farmers group and Ngorin farmers group. Each group comprised of at least 10 persons involved in food crop production either directly or indirectly. These groups enabled us to understand how biophysical and socioeconomic factors have been affecting their production differently. The composition of the groups took into consideration gender issues.

Comment [OO13]: You can make this section more concise and brief.

To complement the primary data, secondary sources were equally consulted to get extant literature in the domain. A lot of publications and journals were consulted online while the archives of institutions such as the Divisional Delegation for Agriculture and Rural Development, publications of Non-governmental organisations working in Mbiame Sub Division were consulted to have a better insight on the trends of food crop production and factors impacting the production for better analysis.

Comment [OO14]: This section is not necessary for this paper. You may delete this.

Collected data from the field was analyzed qualitatively and quantitatively using descriptive and inferential statistical tools to ensure easy appreciation of the facts and figures. Linear regression was used to the correlation between biophysical parameters and socioeconomic factors as determinants of food production, tested at 0.5% level of significance(one-tailed test) .ANOVA (analysis of variance) was also use to analyze the effect of biophysical and socio economic factors on the food crop production. Post hoc multivariate comparison test was used to compare the significant difference between two or more factors revealed by ANOVA. The questionnaires were analyzed using SPSS version 20 and graphs and charts generated in Micro Soft Excel. Finally, the results were subjected to inductive, quantitative and qualitative judgments based on the data collected.

2. Results presentation and analysis

2.1.Socio-economic characteristics of farmers

Comment [OO15]: Use socioeconomic with is not hyphenated.

151 Result of the socio economic characteristics of the respondents are presented in table
 152 1. Sex distribution of food crops producers clearly shows that majority of the villagers who
 153 are into food crop production are females when compare to their male counterpart. From
 154 comparative analysis it shows 81.3% of female participate as against 18.3% Male. The reason
 155 is because women are responsible for feeding the household and food crops are basically for
 156 consumption. McGuire and Popkin (1990) affirm that woman's triple roles as food producers,
 157 income earners, and home managers make them indispensable in the drive toward food
 158 security. Majority of those who are involved in food crop production are adults with a
 159 percentage of 31.3 and 24.7 for the old as compared to 16.7 and 18% for young. The adults
 160 make up the majority because they are settled and active. They have already built their own
 161 families and need to produce food for family sustenance. The youths are not into production
 162 because they are still undertaking training in off farm activities that do not give them time to
 163 embark on production.

Comment [OO16]: Use past tense of show – showed.

Comment [OO17]: Give the actual percent of the villages that qualifies it to be given the word "majority".

Comment [OO18]: Use past tense of show – showed.

Comment [OO19]: Use affirmed

Comment [OO20]: Use towards.

Comment [OO21]: Make it 16.7percent.

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164 Married people dominate production with 53.33% as compare to 26.5, 11.33, 8.67% for
 165 single, divorce and widows respectively. Since food crops are basically for consumption
 166 those who are still single (26.67%) do not engage into it but instead focus on cash crop
 167 production that will give them cash for other adventures.

Comment [OO23]: Provide a reference to support this from the literature.

168 Table 2; Characteristics of food crop producers

Comment [OO24]: You may not need to repeat all the results of analysis in this section. Just briefly and concisely discuss the major ones while the table can be referred to give other details.

Variables	Food crop producers	Percentage
Sex		
Male	122	81.1
Female	28	18.3
Ages		
>10	11	6.6
21-30	25	16.6
31-40	37	24.5
41-50	49	31.1
51-60	27	17.9

Marital status

Single	40	26.5
Married	80	53
Divorce	17	11.3
Widows	13	8.6

Level of Education

No formal education	57	38
Primary school	75	50
Secondary/high school	10	6.7
Tertiary education	8	5.3

169

170 There is a lot of commitment from married people (53.33%) in Mbiame as far as
 171 enhancement of food crops is concerned. This is backed by the fact that they are married and
 172 obviously have children that need to be guaranteed food security. Food crop production is
 173 dominated by those who attended just primary education (50%) and no formal education
 174 (38%). Tertiary and secondary education has 5.3 and 6.7% respectively. Food crop
 175 production is in the hands of those who ended their education at primary level or no
 176 education at all. This is because they turn to agriculture since they cannot compete in other
 177 sectors that require former education though their knowledge have been enhance through
 178 farmer field schools.

179

2.2. Food crop production trends

181 For a better understanding of how biophysical and socio economic impact food crop
 182 production, an analysis of the past trends of production was diagnosed. It is important for the
 183 past trend of output to be establish to ascertain whether food crop production has been
 184 increasing, decreasing or has remained constant. Table 3 clearly depicts the trend of selected
 185 food crops.

186 Table 3; Food crop production trends

Food crops	Decreasing	Increasing	Constant	Total
cassava	6 30.0%	5 25.0%	9 45.0%	20 100.0%
Irish potato	10 50.0%	5 25.0%	5 25.0%	20 100.0%

Comment [OO25]: Use past tense "was"

Comment [OO26]: Use percent.

Comment [OO27]: Use percent

Comment [OO28]: Use percent

Comment [OO29]: Use percent

Comment [OO30]: Use past tense "was"

Comment [OO31]: Provide reference for the justification of this assertion.

Comment [OO32]: You may put percent in bracket for these headings and remove the percent sign from the table. In another words you may but the percent in the bracket and will be beside each figure used in the table. I mean 6 (30percent).

Cocoyam	6	4	10	20
	30.0%	20.0%	50.0%	100.0%
Beans	12	10	0	22
	54.5%	45.5%	0.0%	100.0%
Groundnut	13	4	6	23
	56.5%	17.4%	26.1%	100.0%
Maize	13	10	2	25
	52.0%	40.0%	8.0%	100.0%
Soya beans	10	6	4	20
	50.0%	30.0%	20.0%	100.0%
Total	70	44	36	150
	46.7%	29.3%	24.0%	100.0%

Comment [OO33]: Use indicated.

Comment [OO34]: Use percent and not the sign.

Comment [OO35]: Use percent and not the sign and correct other ones please.

Looking at the cross table analysis above, it can be established with certainty that the general food crop production trend has been decreasing. Cassava production indicates that it has been decreasing by 30% as respondent admitted, 25% disagree that it has been increasing while 45% responded that the output has remained static for the past years. Irish potato does not differ a lot with cassava. 50% accepted that Irish potato has been decreasing while 25% and 25% stood for the fact in has been increasing or constant respectively. Cocoyam, Beans, Groundnut, maize and Soybeans corresponding to 54.5%, 56.5%, 52%, 50% respectively as farmers accepted that the food crops has been decreasing. The reason for this decrease in yields was attributed to biophysical and socioeconomic challenges faced by food crop producers. It is evident from Table 3 that some farmers are witnessing increase in yields and this can be explain by the fact that they are lucky to be located in areas where soils are still fertile like farmers in Mbonso or fortunate to be financially viable.

Biophysical and Socioeconomic analysis

How food crop production progress in any given area or environment depends on the interaction of the biophysical and socio economic parameters such as soil forming factors like fauna and flora, natural disaster such as floods and strong winds, financial viability , land availability among others . Given the hilly topography of the western highlands agro ecological zone which Bui Division is part, production is subject to extreme weather conditions (erosion and winds).

211 **Table 4; biophysical and socio economic factors**

Biophysical and socio economic	Respondents				Total
Parameters	SA	A	D	SD	%
Soil fertility	53.3	6.7	6.7	33.3	100
Pest and diseases	53.3	26	20.0	0.0	100
Climate variability(drought and rainfall	73.3	6.7	13.3	6.7	100
Weed (unwanted grass)	53.3	20	13.3	13.3	100
Natural disasters	33.3	20	13.3	33.3	100
Land ownership	40.0	6.7	6.7	46.7	100
Inadequate inputs(seed, fertilizer, pesticides)	80.0	6.7	6.7	16.7	100
Outdated tools	40.0	6.7	46.7	6.7	100
Credit facilities	53.3	33.3	6.7	6.7	100
Poor road network	90.0	20.0	20.0	0.0	100
Total %	54.0	15.3	15.3	15.3	100

Comment [OO36]: You may not add the total column. It is not necessary.

212

213 SA=strongly agreed, A=agreed, SD=strongly disagreed, D=disagreed

214

215 Table 4, clearly indicates the various production determinants identified by the farmers as the
 216 reason behind yields. The highest rank problem is that of diminishing soil fertility and
 217 climate variability. Socioeconomic variables are equally bringing yields down ranging from
 218 credit facilities which is the highest rank by farmers as their main problem. This is because if
 219 they are financially viable they can take care of other variables such as inputs, farm tools and
 220 land ownership

Comment [OO38R37]: You may add reference(s) to support you findings or refute it from the literature.

221 **2.2.1. Biophysical analysis**

222 Kombiok *et al* (2012) Soil fertility is a great indicator of how successful food crop
 223 production can be realized. In Mbiame soil fertility has been diminishing caused by annual
 224 bush fires which renders the soil bare exposing it to both wind and water erosion during dry
 225 and rainy season respectively. From Table 4, 58% of respondent strongly agreed that
 226 decreasing yields is as a result of reducing soil fertility contrary to 33% who strongly

disagreed that soils are still relatively fertile. These are respondents from Mbonso, Njanawa, Lip and Ngorin with a low lying topography where sediments containing nutrients are washed from hills and deposited. This soil infertility is caused by poor farming techniques especially the *Ankara system* widely adopted by food crop producers, water erosion especially in uphill farms and water logged areas in Njawana.

Pest and diseases has for the past years been a major problem to food crop producers as their crops are often attacked rendering them unproductive or resulting in low yields. Judging from the data analyzed on the table, 53%, 26.7%, 20% strongly agreed, agreed and disagreed respectively that pest and diseases have been affecting food crops. Common diseases here are weevils and stem borer (maize), rosette and *cercospora* leaf spot (groundnut) seedling blight, leaf blight, whiteflies, root rot and mosaic virus (cassava), leaf spot (beans) potato beetle, rodents and early blight (Irish potato), black leaf blight and bacterial blight (soybeans) and pythium, corn root beetle (cocoyam). All these diseases and pest are responsible for reducing yields in Mbiambe Sub division though not uniformly distributed that is why 20% did not witness a major problem from pest and diseases.

Climate variability without doubt is a major reason why food crop yields have been decreasing in Mbiambe Sub division. Food crop production depends solely on rainfall for its water provision. There have been a lot of inconsistencies in the pattern of rainfall which often confuses farmers on when to prepare the land, prepare seeds and plant their crops. Following the past rainfall trends, rains normally come at mid-March which is the planting season but now either it comes early March or late March. These fluctuations cause crops to wilt or weeds to over shadow crops resulting to low yields. From table 4, it can be seen that 80% of food crop producers admitted that climate variability is evident and causing problems to them.

The rate at which weed grows in farms surpasses food crops especially beans, groundnut and soya beans that take short heights making it another major hindrance to crop growth and yields. Weed forms a habitat for pest and diseases that precipitate spoilage of food crops. When farms are prepared for food crop planting, weed first of all uses the nutrients that could be used by crops for growth before they even germinate. Given the rapid growth of weed, food crop production becomes labor intensive and exhaustive since farmers have to be in the farm every after one month to remove them. The general acceptance that weeds is a problem stood at 53% while 20% agreed and just 13% disagreed. The percentage that disagreed

259 comprised those who are into cassava and cocoyam production since they grow above the
260 weed and do not have to compete for water, space and sunlight.

261 Natural disasters are known to be the highest uncertain risk food crop producers always
262 have to battle with. Strong winds often destroy crops especially maize, cocoyam and cassava
263 when they are about attaining maturity.



264
265 **Plate 1 : Destruction of crops by wind storm**

266 At times $\frac{3}{4}$ of food crops are lost as a result of winds. Flood cannot be rule out when
267 discussing food crops and natural disaster. Maize, soybeans, beans and groundnut are
268 vulnerable to floods especially in the plains of mbonso, kovki and njanawa. The percentage
269 of farmers who admitted floods and winds stood at 33% and 20% as they strongly agreed and
270 agreed respectively. Farmers with favorable topography and luck did not share the problem of
271 floods and winds that is why 13.3% disagreed and 33% strongly disagreed.

272 **2.2.2 Socioeconomic analysis**

273 The land tenure system in Mbiame takes two dimension as we have the traditional system
274 where a large area of land is under the control of the Fon of Mbiame who gives out to his
275 subjects when need be. Another tenure system is the inheritance system and under this system
276 land is distributed amongst members of family and as family increases land is equally
277 fragmented in small portions which does not favor production. Land due to its immobile
278 nature will always be a scarce resource. Land is a factor of food crop production meaning it's
279 a major determinant in the food crops yields .Land acquisition in Mbiame is not yet a major
280 hindrance in food crop production but still an issue to an extent. Looking at the statistics
281 obtain from the field, the percentages stood at 40%, 6.7%, 6.7%, and 47.5 for strongly agreed,

282 agreed ,disagreed and strongly disagreed respectively,40% and 6.7% still face problems of
283 land meaning production is hampered by land issues.

284 Farms input are very important given that what we put in is what we expect to
285 harvest. This is a major problem to farmers of food crops as the ability to afford these inputs
286 is difficult given that their purchasing power is too low. The price of fertilizers keeps
287 increasing steadily and given the decreasing rate of soil fertility, yields are bound to reduce
288 considerably. If proper treatment is not taken of crops, they will be attack by pest and
289 diseases and given the difficulty to acquire pesticides, crop failure becomes the rule. 80% of
290 food crop producers strongly agreed that inadequate inputs are a realistic problem to them.

Comment [OO40]: In what? Please add that to that statement.

Comment [OO41]: Use kept.

Comment [OO42]: Recast this phrase.

Comment [OO43]: Add reference(s).

291 Traditional tools have proven laborious and less productive from time immemorial.
292 The continues use of tools like hoes ,cutlasses, spades and oxen makes yields far more less
293 than the potential output. What a tractor does in two hours takes weeks to be done manually
294 making it difficult for farmers to complete farm preparation on time. Looking at the opinion
295 sample from the field, 40% strongly agreed the low yields associated with the use of outdated
296 tools though 47.75 disagreed, blaming yields on other factors of production.

Comment [OO44]: Add percent.

297 Credit facilities affect food crop production in all facets .it cut across from inputs to
298 farm management till harvest. Inability to purchase farm inputs like seed, pesticides, farm
299 tools, hire labor, transportation will make it difficult to enhance food crop production .why
300 the poor farmers keep getting poor is simply because of the inability to put factors of
301 production into effect. According to opinion sample from the field, 86% admitted not having
302 access to finances as a major hindrance to food crop production. 6.7% disagreed and 6.7%
303 strongly disagreed that credit facility was not their problem.

304 Food crop production cannot see the light of the day if accessibility is not ensured.
305 Road network in Mbiame is not commendable as having access to farms at certain months
306 (late July, August and September) is difficult and this slows down attention given to crops
307 and their related effects like pest and diseases attacking crops because of untimely attention
308 and transporting inputs into the farm. When the opinions of farmers were sampled, 60%
309 strongly agreed while 20% agreed meaning poor road network is a reality in Mbiame.

310

311 **Table 5; Biophysical and socio economic factors multi compared.**

(I) Biophysical Factors	(J) factors	Mean difference (I-J)	Std. Error	Sig.
Soil fertility	land ownership	-.73333 [*]	.21705	.042
	Outdated tools	-.93333 [*]	.21705	.001
Pest & diseases	land ownership	-1.13333 [*]	.21705	.000
	Inadequate inputs	-1.06667 [*]	.21705	.000
	Credit facilities	-.93333 [*]	.21705	.001
Climate variability	land ownership	-1.40000 [*]	.21705	.000
	Inadequate inputs	-1.33333 [*]	.21705	.000
	Credit facilities	-1.20000 [*]	.21705	.000
Weed(unwanted crops)	land ownership	-1.40000 [*]	.21705	.001
	Inadequate inputs	-1.33333 [*]	.21705	.000
	Credit facilities	-1.20000 [*]	.21705	.000
	Poor road network	-.93333 [*]	.21705	.000
Natural disaster	Inadequate inputs	-1.00000 [*]	.21705	.000
	Credit facilities	-.86667 [*]	.21705	.005
Socio economic(I)	Biophysical(J)			
Land ownership	Soil fertility	.73333 [*]	.21705	.042
	Pest and diseases	1.13333 [*]	.21705	.000
	Climate variability	1.40000 [*]	.21705	.000
	Weed	1.40000 [*]	.21705	.000
	Natural disasters	1.06667 [*]	.21705	.000
Inadequate inputs	Pest and diseases	1.06667 [*]	.21705	.000
	Climate variability	1.33333 [*]	.21705	.000
	Weed	1.00000 [*]	.21705	.000
	Natural disasters	1.33333 [*]	.21705	
Outdated tools	Pest and diseases	1.33333 [*]	.21705	.000
	Climate variability	1.60000 [*]	.21705	.000
	Weed	1.26667 [*]	.21705	.000
	Natural disasters	1.60000 [*]	.21705	.000
Credit facilities	Pest and diseases	.86667 [*]	.21705	.001
	Climate variability	1.20000 [*]	.21705	.000
	Weed	1.20000 [*]	.21705	.005
	Natural disaster	.93333 [*]	.21705	.000
Poor road network	Climate variability	.93333 [*]	.21705	.001
	Weed	.93333 [*]	.21705	.001

*. The mean difference is significant at the 0.05 level.

Post hoc multivariate comparison is test used when there is a significant difference between two or more samples revealed by ANOVA

313 From the above analysis, it shows that some of the factors when compared are significant
314 while others are not. Soil fertility when combined with pest and diseases is not significant at
315 0.05% level. This is because the p-value is 1.000 which is greater than the 0.05% significant
316 level with a mean difference of .40000 in decreasing yields which implies that food crop
317 production is not hindered by these two factors when compared. It can be explained by the
318 fact that if soils are fertile they can counter the problem of pest and diseases.

319 Pest and diseases when combined with land ownership is significant at 0.05% level of
320 significance. This is because the p-value is 0.000 which is below the significant level. To this
321 effect, food crop production is decreasing as a result of pest and diseases when combined
322 with land ownership.

323 Climate variability when combined with credit facilities is significant at 0.05% significant
324 level. This is because the p-value =0.000 (with a mean difference of -1.13333) which is
325 below the error margin. To this effect, that food crop production is decreasing because of
326 these two factors. If climate variability was counteracted by adequate credit facilities this
327 could not be a problem to food crop producers.

328 Natural disaster when combined with soil infertility is not significant at 0.05% significant
329 level. This is because the p-value=1.000 (mean difference -.33333) which is above the level
330 of significance. As a result, decrease in food crop production is not as a result of natural
331 disaster and soil infertility. This can be explained by the fact that these two factors act
332 independent of each other.

333 Inadequate credit facilities when combined with weed (unwanted crop) are significant at
334 0.05% level. This is because the p-value=0.000 which is below the significant level. To this
335 effect, decreasing food crop production is as result of inadequate finances and weed. If there
336 is no capital it is difficult to control weed since herbicides to suppress weed cannot be
337 afforded and equally to hire labour.

338 **Conclusion and recommendations**

339 The level of food crop production is determined by the ability of the farmers to optimize the
340 determinants of food crop yields which falls within biophysical and socioeconomic

parameters. Mohammed (2011) explained that yields gaps are mainly caused by biological, socioeconomic, climate and institutional policies. Enhancing food crops implies that productivity should be maximized from the determining factors and this can be done by applying these various techniques improve seeds, inorganic fertilizers (replenish Nitrogen and Potassium contain of the soil), use of compost manure and animal droppings at the input level. Equally the improvement on farming techniques such as conservative and soil sustainable methods like slashing and mulching, minimum tillage, direct seeding, agroforestry, cover cropping, intercropping and weed management with the interactions of socio economic variables. Achieving and attaining food security cannot be concluded without mentioning the indispensable efforts extension agents are putting in especially in capacity building and establishment of farmer field schools.

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