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Determinants of Crop Production Failure in Kuyu Woreda, North Shoa, Oromia Regional State, Ethiopia

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Abstract
This is the research article looked into Determinants of crop production failure across agro-climatic zone of the kuyu woreda, North Shoa, Oromia regional state. Hence, the main objective of the study was to analyses shared factors affecting crop production failure across agro-climatic zone of the study area. From sampled households, relevant data were collected through questionnaires, key informants, focus group discussion and reviews of document. The generated data were analyzed through Kruskal Wallis test, chi-square, mean and percentage, and presented in table, graph and words to ends objectives. Accordingly, it was found that crops were failed due to some biophysical and socio-economic factors in Kuyu woreda. Thus, extreme temperature, extreme rainfall, drought, crop pests, flood storm, hail storm, weeds, frost, unavailability of farming labor, unavailability of draft animals and farming inputs were major constraints to crop production in the study area. Kruskal Wallis statistical calculation results indicate that all aforementioned impediments to crop production were not significantly different among dega, woinadega and kola agro-climatic setup of Kuyu woreda in causing crop production failure except flooding. Therefore, unlike flooding, all other shared identified factors are causing crop production failure in dega, woinadega and kola parts of kuyu woreda.
Keywords: - Crop production failure, Agro-climatic zone and determinant of crop production.

Introduction

Crop production forms the basis of rural economies throughout the developing world. According to IFPRI (2007), while there is a growing industrial sector in many African cities, agriculture still provides the dominant livelihood for 65 percent or more of Africa's population. However, UNESC (2007) report indicated that agricultural productivity levels in Africa is still lag far behind even than other developing regions. This is because; much of growth of agricultural output in Africa has been due to expanded use of land and labor. This report confirm that the total of factors of production grew in Africa at an annual rate of 1.3% on average during the 1990s, accounting for approximately 40% of the 3.1%annual growth in agricultural output. Growth in the traditional inputs of land, labor, and livestock accounted for the other 60% of agricultural output growth.

According to DFID (2007), agriculture is back bone of Ethiopian society because, the country's economy is typically an agricultural economy and agriculture is the source of livelihood. But crop production is unsecured in different part of Ethiopia. This report confirm that the national crop harvest vary up to 25% between successive years. Furthermore NMA (2007) and Alemu et al (2005) indicated that in Ethiopia, crop performance is depending on Meher and Belg season rainfall pattern. Variability on seasonal rains has kept crop production and productivity very low in Ethiopia. Especially, Arid, semi-arid, and dry sub-humid areas of the country experience very high seasonal and inter annual rainfall variability that causes crop production failure. According to DPPC (2003) and MoA (2012) report, major crops grown in the part of Oromia region mainly in North Shoa zone (in which kuyu woreda is part) only 18% of the planned area was covered with crops in 2012.

Kuyu was one of the important productive woreda of North Shoa, Oromia regional state suitable for crop production. However, most of the areas within the woreda had been facing crop production failure recently. In this Woreda, the farmers were not harvested crops at expected intensity that contradict current government plan and interest. By indicating governments interest, MoFED (2006) report revealed that like other few areas, North Shoa zone (kuyu woreda is located in) has been identified as crops growth corridor for its comparative advantages. But things were not as expected; rather most dominantly known crops to the Kuyu area failed to give yield. So, this increased food aid beneficiaries in the woreda as crop production is means of their livelihood. For instance, data obtained from MoA (2012) indicated that about 3,301 households in Kuyu woredas were under food aid program due to crop production failure. But, these episodes were not the experience of the area in the past decades. Thus, the variety of crop hold on risk increases from time to time by following bad year, because some area of the woreda were abandoned from crop production ambitions currently.

Hence, what makes this problem worth studying is to have clear understanding on the level and cause of crop production failure in Kuyu woreda. So, in this study, major emphasizes was given for constraints to crop in kuyu woreda. Therefore, identifying major cause of crop production failure which this study focuses on is very imperative to take measures that reduce the present circumstance of crop production failure in Kuyu woreda.

Objective of the study

a. General objective

The general objective of this study was to assess Shared Determinants of crop production failure across agro-climatic zone of the study area.

b. Specific objective

The specific objective of this study was:-

- ✓ To assess level of cop production failure in the study area.
- ✓ To analyze major bio-physical cause of crop production failure across agro-climatic zone of the study area
- ✓ To analyze socio-economic causes of crop production failure across agro-climatic zone of the study area.

Materials and Methods:-

Relief and agro-climatic zones of kuyu woreda:

High and rugged mountain ranges that are flat-topped, deep gorges, hills, and plains characterize the study woreda. The altitudinal range of the Kuyu woreda is from 2757m to 1390m above sea level that covers three agro-climatic zones i.e. dega, woinadega and kola (KWAO, 2012/13). See table 1 below.

The most commonly used climate classification systems used in Ethiopia is agro-climatic zone. Agro-climatic zone classification system in Ethiopia is based on altitude and temperature. Hence, Ethiopia has five climatic zones (Dejene, 2003).

Table 1 agro-climatic zone of Ethiopia

Zone	Altitude	Average Annual Temperature ($^{o}{}_{C}$)
Wurch(cold and moist)	3200 plus	>11.5
Dega (cool and humid)	2300-3200	17.5/16.0-11.5
Woina Dega (cool sub-humid)	1500-2300	20.0-17.5/16.0
Kola(warm semi-arid)	500-1500	27.5-20.0
Berha (hot arid)	Under 500	>27.5

Source: Dejene (2003)

Crop production:-

According to information obtained from KWAO, (2012/13), the rainfall for the kuyu woreda is closely determined in four months: June, July, August, and September. Over half of the overall rainfall is gained in these months. Hence, greater part of the food crops such as *teff*, wheat, barley, sorghum *and* the like are sown during the first or second months of this major rainy season in the area. In reality, important amount of rainfall is gained through the three months of belg season (March, April and May) creating second essential rainfall for the study area. As a result, Sorghum, one of the most ordinary food crops in the area, is sown mainly in the first months of this season.

Table2 Displaying planting, weeding and harvesting time of the cereal in kuyu woreda

Cereal	Scientific name	Planting time	Weeding time	Harvesting time
Teff	Eragrostis tef	July	August, September	November, December
Wheat	Triticum Aestivum	July	August, September	November, December.
Barley	Hordeum vulgare	May, June	July, August	October, November.
Nug	Guizotia abyssinica	June	-	October, November.
sorghum	Sorghum bicolor	March	May, June	December ,January

Source: own survey, 2016

Evidence from MoA (2012) shows that, the longest delay and the longest earlier withdrawal of rainfall experienced in North Shewa. As the result, the performance of the 2012 *belg* and *genna* rain fall is considered below normal. Consequently, crop production activities were hindered in North Shoa/Selale in which kuyu woreda is in part.

Sampling design:-

Kuyu woreda is one of the 14 woreda of north shewa/selale zone. The researcher focused on this woreda because, the study area has been facing crop production failure and most farmers in the woreda get less food supply due to periodic crop production failure. Purposive sampling method was employed to select 23 rural kebele of Kuyu woreda out of 25 kebeles as crop production activities is no such concern of remaining two urban kebeles of Kuyu woreda. Yet again, as the population understudies (23 rural kebele) are heterogeneous in exercising crop production activities across dega, woinadega and kola agro-climatic zone of the woreda, the researcher selected eight rural kebeles of kuyu woreda that constitute aforementioned agro-climatic setup by purposive sampling method. This was carried out because of the following assumption, 1st these kebeles constituting all the three (dega, woinadega and kola) agro climatic zones, randomly as proportional as that of the woreda, 2nd these kebeles expected to represent the woreda in terms of institutional, livelihood strategies, socio-economic and biophysical characteristics adequately, 3rd spatial accessibility these kebeles have.

From these identified eight rural kebeles, two kebeles were selected by using simple random sampling method. This is because it gave equal chance for all population understudies that were selected and the selected kebele was believed to be representing in reflecting the character of the remaining parts of the kebele. At this stage, the developmental agents (DA) were consulted to identify the location of each household within both kebele. Accordingly 100 households were selected by Emane formula, in focusing on published tables on 10% precision level. By using probability proportional to size (PPS), sample was taken from each kebele. Through systematic sampling method individual household was derived from the each group.

Data sources:-

In this study, the researcher was used both primary and secondary data for the investigation of the problem. This was to make the study all rounded and efficient. In addition, these data was expected to cover the entire problem that was assessed. The primary data was collected from the agrarian households, developmental agents (DA), and key person from woreda agricultural bureau. The secondary data was collected /gathered from websites, central statistical agency document, NMSA, report of ministry of agriculture (published and unpublished).

Technique and methods of data collection:-Number of data collection technique like key informant interview, personal observation and questionnaire were used to gather relevant and appropriate information relating to problem under study.

I Key informants

The selection of key informants was undertaken by using purposive sampling method. Total of 12 key informants interviews were undertaken. Therefore, the key informant interview was conducted with six elders, three Developmental Agent (DA), two administrators of kebele and one head of agricultural office to get real information from their brainstorming about the problem (crop failure).

II Focus group discussion

The number of focus group discussions was determined by saturation of ideas (until a point where no more new idea emerged). Accordingly, Two Focus group discussions on each of the selected rural kebeles were selected. A total of four (4) different Focus group discussions were conducted. The members of each group were nine (9). The purpose of the gathering was explained briefly and the groups discussed on the problem understudy (crop failure). Hence, relevant inhabitants' experiences, opinions, needs, and constraints were collected as per of the objective of the study.

III Review of documents:-

The data relevant to the problem was collected from the web sites, related written material on market, different agricultural office, WSU library to make the study more power full, credible, and acceptable. This review of document was expected to guide overall framework of the research and enriches the data that was collected.

IV Questionnaires:-

The questionnaire was expected to be the principal source of the data gathering tools in this research more than the other. It was designed to both close and open ended question by English language and was translated to Afan Oromo for the sample respondents aiming for the clarity. Then the questionnaire was distributed to sampled household to gather relevant data to the problem under study.

Method of data analysis

Content analysis was used to evaluate data collected through focus group discussion, key informants, questionnaire and review of documents in context of objective one (assessing level of cop production failure). Content analysis is relevant for objective one. According to Nachmias and Nachmias, (1976), Content analysis is method where the content of the note forms the basis for drawing inferences and conclusions to context. Therefore, transcribed data (note) from focus group discussion and key informants, plus review document were scrutinized through content analysis to achieve objective one.

Data collected through questionnaire was tabulated and interpreted based on descriptive statistics and kruskal wallis test as per of agro-climatic zone of kuyu woreda to achieve objective two and three. In addition, data collected from key informants and focus group discussion were also used to get enhanced understanding of problem understudy. Kruskal Wallis statistical calculation was used to decide the statistical variation of temperature, rainfall, drought, flood storm, weeds, frost storm, crop pest, hail storm, draft animals, farming labor and farming input in relation to crop production performance across dega, woinadega and kola agro-climatic zone of the kuyu woreda.

Accordingly, data that were gathered from different source were compiled, organized, summarized and interpreted based on descriptive statistics through SPSS 19.0 and Microsoft excel 2010 computer-based statistical package.

Result and Discussion:-

Based on the objective of the study, the following section discusses about the level of crop production failure, biophysical and finally, socio-economic factor that cause crop production failure across agro-climatic zone of kuyu woreda as follows.

Level of Crop Production Failure in the Kuyu Woreda:-

As crop production is mainstay of Ethiopia, laterally, you can think that crop production is convinced human activity in the area. But things are different as crop production is unconvinced activity currently. Muller et al (2011) generalized that crop production is inefficient in Africa in relative to other parts of the world. Additionally, Tenna (2012) indicated that Ethiopia was major food aid recipient among sub-Saharan countries due to crop failure. Likely, most respondents showed that crop production is unfortunate deeds as crop yield is less than crop producers' effort in kuyu woreda. In consistence to this, Messay (2011) indicated that crop yields have been getting worsen over year in contrast to some two or three decades back in kuyu woreda. The data generated from the household respondents were also confirmed above statement. According to these collected data, about100 (99%) of household respondents were facing crop production failure in the kuyu woreda . From this one can conclude that the level of crop production failure in kuyu woreda is high. For this high level of crop production failure, the researcher was able to reach on number of **indicators** as revealed next,

- low level of household satisfaction to crop production,
- crop produced/harvested below expectation of peasants,
- aggregate of household meeting crop failure and
- collapsing of crop production in the study area

These indicators were organized from household respondents, key informants, focus group discussion and review of documents to justify the presence of the level of crop production failure in the kuyu woreda. The detail of these indicators for the high level of crop production failure in the kuyu woreda is presented as follows.

Low level of household satisfaction to crop production:-

Crop production is means of livelihood for most of kuyu woreda's farmers. But, crop production failed to meet the interest of most of crop producers currently. Accordingly, level of satisfaction from crop production was very low in this locality. Table 3 reveals detail of this idea.

Table3. Level of household satisfaction to crop production across agro-climatic zone of study area (N=100)

Level of household satisfaction to crop production	Agro-climatic zone							
	dega		woinadega		Kola		Total	
	N	%	N	%	N	%	N	%
Very much unsatisfied	22	55	16	38.1	6	33	44	44
unsatisfied	7	17.5	4	9.5	5	28	16	16
Indifferent	9	22.5	22	52.4	7	39	38	38
satisfied	1	2.5	0	0	0	0	1	1
Very much satisfied	1	2.5	0	0	0	0	1	1
Total	40	100	42	100	18	100	100	100

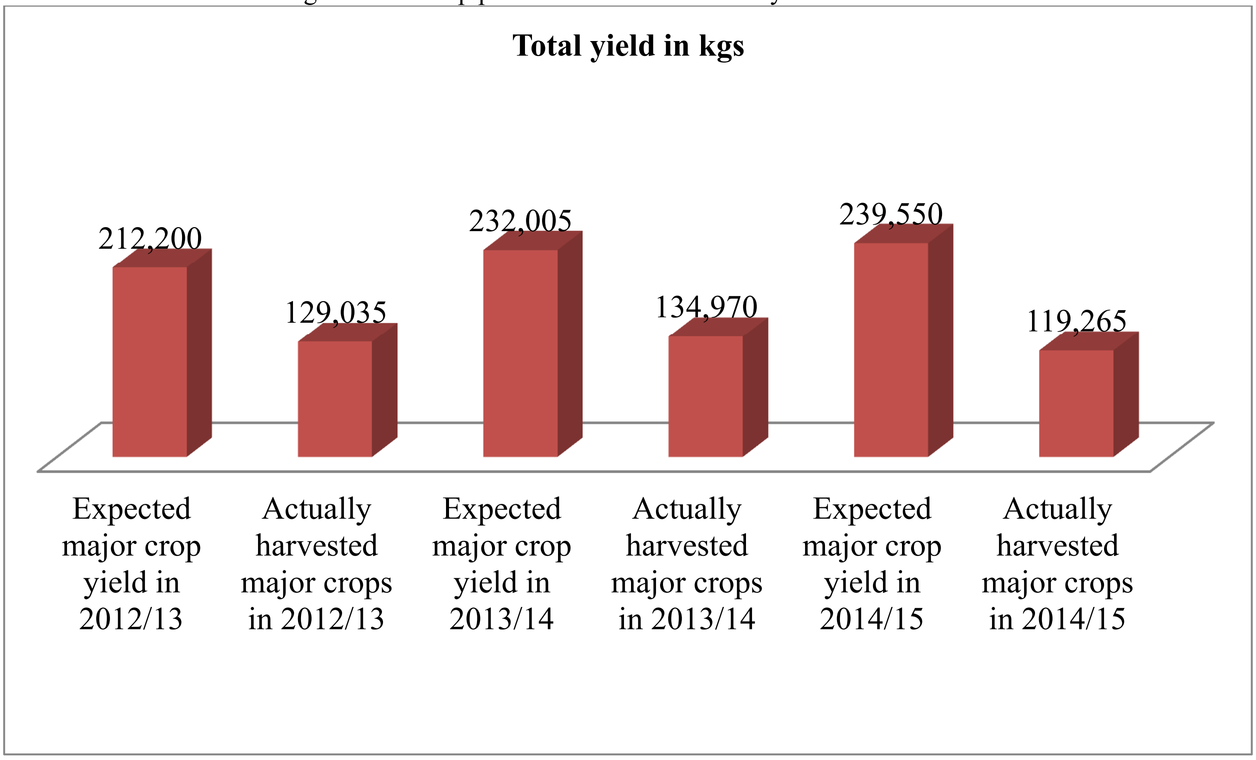
Hint. **N**- represents number of household respondents

Source: Field survey, 2015/6

Major parts of the respondents were not satisfied with crop production in kuyu woreda. Table 3 above confirmed that about 44% of respondents were very much unsatisfied, about 16% of respondents were unsatisfied and about 38% of respondents were indifferent (in and out feeling) for crop production. As figured above, most farmers were dissatisfied with crop production activities in general. This indicated that crop producers of the study area had low interest in producing crops. As the most household respondents and focus group discussion member reason out, they did more, they expected more crop yield, in the contrary they got less crop yield and then dissatisfied with crop production activities. Thus, most farmers of the area lost confidence in producing crops. From these all above ideas, the researcher summarized that low level of household satisfaction with crop production activities could be an indicator for high level of crop production failure in the kuyu woreda.

Explicitly, farmers' level of satisfaction to crop production is different across agro-climatic setup of the kuyu woreda. As summarized in table 3, the level of farmer household satisfaction with crop production in dega agro-climatic zone was found very low in comparing with farmers of woinadega and kola agro-climatic zone of the area. For instance, about 55% of sampled respondents of dega household were highly dissatisfied to crop farming activities that followed by 38% and 33% in woinadega and kola respectively. From this, the researcher understands that passion of peasant to crop production was low in dega agro-climatic zone than woinadega and kola agro-climatic setup of the area.

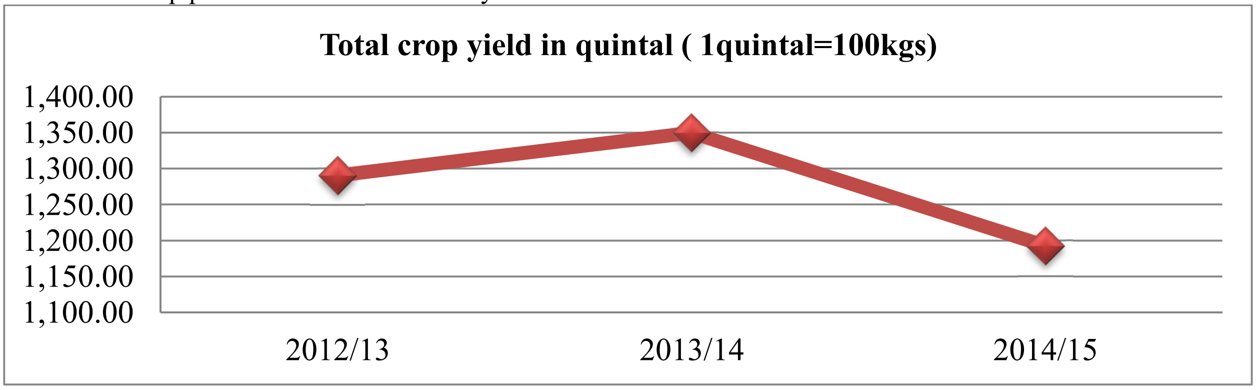
Crop produced/harvested below expectation of peasants:-
The summarized data in Fig.1 from household respondents indicated that crop yield was below expectation of crop producers of the area. For example, in 2012/13 the total crop yield expected were about 212,200kgs, in 2013/14 the total crop yield expected were about 232,005kgs and, in 2014/15 the total expected crop yield were about 23,955kgs but only about 129,045kgs, about 134,970kgs and about 119,265kgs were actually harvested by the household respondents respectively. Amazingly, the household respondents did not find any major crop yield (teff, wheat, barley, nug, sorghum and bean) nearly above or equal to their expectation in stated year. This all indicate that most household farmers faced crop failure in kuyu woreda. So, harvesting crop below expectation was best manifestation of high level of crop production failure in the kuyu woreda.



Source: Field survey, 2015
Fig.1 Expected and actually harvested crop yield in 2012/13-2014/15

Aggregate of household facing crop failure:-
Almost all farmer households in kuyu woreda were faced crop production failure by all or part of crop type they were farming. The result of the present study confirms that almost every farmer in any agro-climatic zone of kuyu woreda was facing crop production failure.

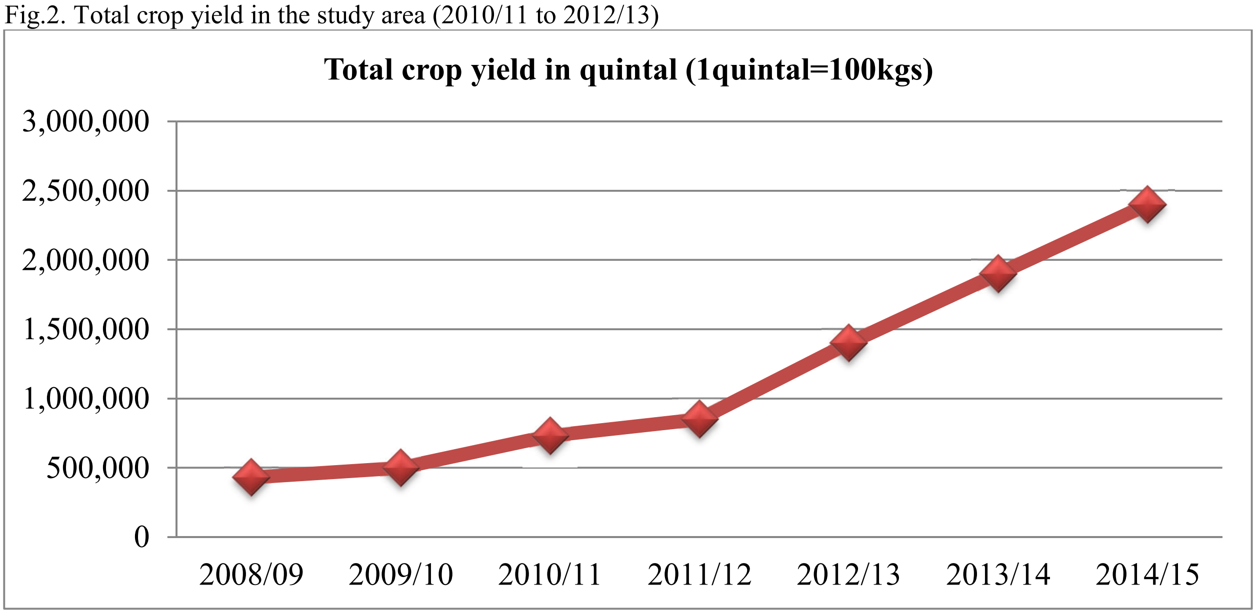
As the collected data from household respondents indicated, almost all household in dega, woinadega and kola agro-climatic setup of the woreda were encountered crop failure in part or all of crop type produced. Summarized data from respondents confirmed that about 99% of sampled household respondents were faced crop production failure. This figure showed that reduction in crop production and productivity knocked the door of every peasant by some or all variety of crops. Accordingly, the aggregate crop yield of these respondents summarized in fig.2 shows, the household respondents' crop yield was decreased in 2014/15. For instance, total crop produced by respondents were 1,290.45quintals, 1,349.7 quintals and 1,192.65 quintals in 2012/13, 2013/14 and 2014/15 years respectively (fig.2). This indicates that the crop production failed highly in the year 2014/15. The MoA (2012) forecasted reports settled the above statement. According to this MoA prediction, crops were failed throughout North shewa zone (study area located in) in 2012. In contrary to aforementioned finding (idea), data obtained from agricultural office of kuyu woreda (2015) shows that crop production and productivity increased from year to year (Fig.3). According to this agricultural office, crop production and productivity increased in every agro-climatic setup of the woreda. Most interviewed officers of the woreda assured that most farmer households reached the level of self-sufficiency. But, based on data generated from the heart of sampled farmer households, focus group discussion members, and personal observation and different written material, researcher concludes that most farmer households of the area faced crop production failure. Thus, could be indicator of crop production failure in the kuyu woreda.



Hint: one (1) quintal equal with 100kilograms (Quintal is most repeatedly used unit of measurements used to measure amount of crop in Ethiopia)

Source: Field survey, 2015/6

Fig.2. Total crop yield in the study area (2010/11 to 2012/13)



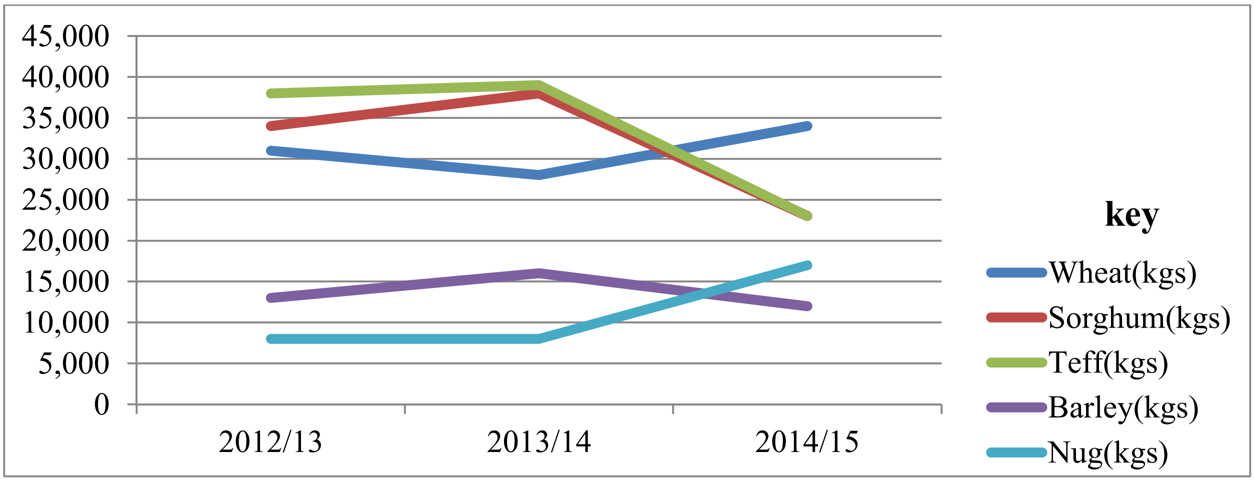
Hint: one (1) quintal equal with 100kilograms (Quintal is most repeatedly used unit of measurements used to measure amount of crop in Ethiopia)

Source: KAO, 2015

Fig.3. Total crop yield in kuyu woreda (2008/09 to 2014/15)

Typical collapsing of crops production in kuyu woreda:-

From the household respondents, focus group discussion and kuyu agricultural office, the researcher found that teff, sorghum, barley, wheat and nug are most dominantly cultivated crops in the kuyu woreda. Especially sorghum and teff are broadly cultivated crops in kuyu woreda as it is most important source of food in kuyu woreda. However, these dominant crops in kuyu woreda were reported to remain declining (see Fig.4).



Source: Field survey, 2015/6

Fig.4 Showing, waning of crops production in the kuyu woreda

As the data generated from the household respondents shown on the above (Fig.4), yield of key crops to the study area like barley, teff and sorghum declined in 2014/15. Thus, the farmers of the area were not harvested crops at expected level that contradict government plan and interest. By indicating governments interest, MoFED (2006) report revealed that like other few areas, North Shoa zone (kuyu woreda is located in) has been identified as crops growth corridor for its comparative advantages. But things were not as expected; rather most dominantly known crops to the Kuyu area failed to give yield (see Fig.4). So, this increased food aid beneficiaries in the area as crop production is means of livelihood in the woreda. In line with this MoA (2012) report indicate that about 3,301 beneficiary farmers were projected to get 367MT in kuyu woreda in 2012.

Which crop variety was failed more than the other in the study area? The crop production failures were varying among crop varieties in the kuyu woreda. Summarized data obtained from household respondents in Table 4 shows, crop productivity per hectare owned by each sampled household in 2014/15 year. Accordingly, this table portrayed that sorghum gave less yield of 249.2kg/ha, which followed by teff, barley, nug and wheat with 289.8kg/ha,304.8kg/ha, and 341.4kg/ha respectively. From this figure one can confidentially say that sorghum was number one crop at risk in relative to other crops in this woreda.

What is the condition of crop production across agro-climatic zone of the study area? An effort was also made to display the dissimilarity in crop yield by agro-climatic zone in Kuyu woreda and it was found that more proportion of the peasants in kola had less fortunate to suitable crop production than those living in woinadega and dega climatic setup of the area(see table 4) .For instance, from about 44.6 hectare of farm land, household respondents were harvesting 8675kg crop yield (by ratio of 194.5kg/ha) in 2012/13 that followed by 68740kg from 235.5 hectare (by ratio of 291.9kg/ha) and 38100kg from 105.33 hectare (by ratio of 361.7kg/ha) in kola, woinadega, and dega agro-climatic setup of the area respectively. From this one can confidentially say that the lowlanders (kola) faced crop production failure than those crop producers living in dega and woinadega agro-climatic zone of the woreda in 2014/15 year.

Table4. Farmstead yield and cultivated land across agro-climatic zone of the study area, 2015/16

	dega		woinadega		kola	
Crop variety	Cultivated land (ha) *	Harvested crop yield (kg) **	Cultivated land (ha) *	Harvested crop yield (kg) **	Cultivated land (ha) *	Harvested crop yield (kg) **
wheat	22.9	9850	61	18750	11.3	3900
barley	11.3	5400	32	7800	0	0
nug	7	2400	33.5	11640	6.8	1925
sorghum	31.13	9400	47.25	13950	20.5	1300
teff	33	11050	61.75	16600	6	1550
Total	105.33	38100	235.5	68740	44.6	8675

Hint: * is cultivated land in hectare per total respondents
** is harvested crop yield in kilograms per total respondents

Source: Field survey, 2015/6

Causes of crop production failure in kuyu woreda:-

One of the research objectives was to identify major cause for crop production failure in the kuyu woreda. This section presents household farmers' viewpoints of why they encounter crop production failure. Hence, factors that caused crop production failure were grouped into biophysical and, socio-economic factors based on the nature of their occurrence. Not all factors have similar influence on crop production across dega, woinadega and kola agro-ecological zone. Hence, Kruskalwallis statistical calculation was used to see if biophysical and socio-economic factor causing crop production was vary across these agro-climatic set up of the study area.

Bio-physical cause for crop production failure:-

Farmers are vulnerable against crop losses caused by hail storm, drought, extreme temperature, excessive rainfall, frost storm, pests and flooding (DPPC, 2003; DPPC, 2006; Degeffa, 2005; FAO, 2008). Similarly, the researcher finding also shows that these aforementioned factors were causing crop production failure in the study area as discussed here under. To identify whether the influence of these factors are significant difference or not among agro-climatic zone of the study area, Kruskal Wallis statistical calculation was used.

A. Extreme temperature

The crops failed to give required yield in kuyu woreda. The household respondents felt that temperature was one among other that caused the crop failure. Accordingly, Iglesias et al (2009) indicated that high temperatures during developmental stage of crop are injurious that results for crop yield drop. Data summarized from household respondents in the table 5 below supports above idea.

Table5. Incident of extreme temperature on crop production in the kuyuworeda (N=100)

Agro-climatic zone	Incident of extreme temperature on crop production					Kruskalwallis test result
		Low	Medium	High	Total	**Test Statistics(a)((b)**
Dega	N	2	17	21	40	Normalized residual
	%	5	42.5	52.5	100	Chi-Squar___ 4.122
Woinadega	N	10	22	10	42	df ___________ **2**
	%	23.8	52.4	10	100	Asymp .Sig.__ 0.127
Kola	N	0	0	18	18	
	%	0	0	18	100	
Total	N	12	39	49	100	a. Kruskal Wallis Test
	%	12	39	49	100	b. Grouping Variable: Agro-climatic zone

Incidence of extreme temperature has no significance difference across agro-climatic zone at (x^2, p >0.05) *(Hint: N- represents number of household respondents)*

Source: Field survey, 2015/6

When the Kruskal Wallis statistic was calculated to determine whether there was any statistically significant difference in the voting of household respondents for the impact level of temperature incident on crop production across agro-climatic setup of the area ($x^2 = 4.122$, $\rho = 0.127$), no statistically significant difference was found among dega, woinadega and kola agro-climatic zone of the area (Table 5). From this one can conclude that the household respondents felt the incident of extreme temperature on crop production across agro-climatic setup of the area. In supporting above idea, the Mohr (2010) indicated that crop yield dropped when the threshold of temperature values for a crop in a given region is exceeded only. This indicated that crop production failed when temperature became above or below the potential of the crop in any agro-climatic zone. So, the researcher decided to saw the aggregate vote of all sampled household on incident level of temperature impact on crop production. Accordingly, About 49%, 39% and 12% of (100) total household respondents believed that incident of extreme temperature on crop production was high, medium and low in the study area respectively (Table 5). Furthermore, the interviewed household, Focus group discussion members and DA of the selected kebele's felt that the temperature hindered effectiveness of crop production in the area. From this the researcher achieved that temperature caused crop production failure in the study area.

B. Extreme Rainfall

Kassahun (2011) and Wairiu et al (2012) finding shows that change of rainfall amount and pattern significantly reduce total crop yield through affecting planting time, growing stages, and harvesting periods. Similar to the above finding, the researcher was able to find negative impact of the rain fall on the crop in kuyu woreda. The table 6 below indicates the summary of the sample household response.

Table6. The incident of the extreme rainfall on crop production in the kuyu woreda (N=100)

Agro-climatic zone	Incident of the extreme rainfall on crop production								Kruskal wallis test result
	Low		Medium		High		Total		Test Statistics(a)((b)
	N	%	N	%	N	%	N	%	Normalized residual Chi-quar_ 0.375 df ________2 Asymp.Sig.__0.829
Dega	1	2.5	15	37.5	24	60	40	100	
Woinadega	3	7.14	20	47.6	19	45.2	42	100	
Kola	11	61.1	2	11.1	5	27.8	18	100	
Total	15	15	37	37	48	48	100	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone

Incidence of extreme rainfall have no significance difference across agro-climatic zone at (x^2, p >0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

Table 6 shows that about 60% of dega household respondents were felt high incident of rain fall record on crop production than the woinadega (45.2%) and kola (27.8%) agro-climatic zone. But, Kruskal Wallis statistical test result (x^2=0.375, p=0.829) showed that there was no significant difference at (p=0.05) significance level among group of household responses to the incident of rain fall record on crop production throughout dega, woinadega and kola agro-climatic zone of the study area. This finding showed that the extreme rainfall adversely affect crop production in every agro-climatic setup of the study area. In line with this Siefu (2004) and Dida (2013) finding also showed that extreme rainfall negatively affect crop production as crop production is suspended to rain fall in Ethiopia. Therefore, the researcher concludes that extreme rain fall that occurred was causing crop production failure across agro-climatic zone of the study area.

C. Drought

Dida (2013) and Iglesias et al (2009) indicated that drought is extreme climatic events that adversely affect the cop production. Crop yields are most likely to suffer if drought occurs during critical developmental stages of the crop. In most grain crops, flowering, and grain-filling are especially sensitive to drought. The researcher finding from household respondents also showed that drought was one among other that affect crop yield in the kuyu woreda.

Table 7 the incident of drought on crop production in the kuyuworeda (N=100)

Agro-climatic zone	Incident of drought on crop production								kruskalwallis test result
	Low		Medium		High		Total		Test Statistics(a)((b)
	N	%	N	%	N	%	N	%	Normalized residual Chi-Squar____4.022 df__________2 Asymp.Sig._ 0.134
Dega	3	7.5	16	40	21	52.5	40	100	
Woinadega	3	7.5	23	54.8	16	40	42	100	
Kola	5	27.8	1	5.6	12	66.7	18	100	
Total	11	11	40	40	49	49	100	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone

Incident of drought have no significance difference across agro-climatic zone (x^2, p >0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

As highlighted on the table 7 above, the drought problem on crop production was felt strongly by group of household respondents in kola (66.7%) that followed by dega (52.5%) and woinadega (40%) agro-climatic zone of the area. Laterally, this table indicates that drought caused crop production failure throughout agro-climatic setup of the area differently.

But, when Kruskal Wallis statistics was calculated to determine whether there was statistically significance difference or not in sounding of household respondents to the level of drought impact on crop production across ago-climatic setup of kuyuworeda, no statistically significance difference(x^2=4.022,p=0.134) between dega, woinadega and kola agro-climatic setup of the woreda was found. Thus, the researcher identified that drought caused crop production failure in the study areas. Yergalem (2009) finding supports this idea. According to his finding, drought is the major factor that causes crop production failure. Additionally, IFAD (2009) report also indicated that drought is principal sources of risk and uncertainty in crop production agriculture in the world. Therefore, from all these information, the researcher concluded that drought played key role in causing crop production failure across agro-climatic zone of the study area.

D. Flood storm

According to Devalsam et al (2011) and IFPRI (2010), flooding has significant impacts on crop production. In the same way, the researcher ascertained that flooding was critical factor that caused crop failure in kuyu woreda. The influence of the flood on the crop was high at early stage of crop growing. It was also observed that the impact of flooding on the crop production was vary from place to place based on nature of the topography, the nature of vegetation cover and human interventions in the drainage area. The vote of household respondents on the flooding summarized in the table 8 showed as impact of flooding on the crop was varied across dega, woinadega and kola agro-climatic zone of the kuyu woreda.

Table 8.the influence of flooding on crop production in the kuyuworeda (N=100)

Agro-climatic zone	Influence of flooding on crop production					Kruskalwallis test result
		Low	Medium	High	*Total*	**Test Statistics(a)((b)**
Dega	N	4	11	25	***40***	Normalized residual Chi-Squar____6.064 df__________2 Asymp. Sig.__ 0.048
	%	10	27.5	62.5	***100***	
Woinadega	N	4	20	18	***42***	
	%	9.5	47.6	42.9	***100***	
Kola	N	2	3	13	***18***	
	%	11.1	16.7	72.2	***100***	
Total	N	10	34	66	***100***	a. Kruskal Wallis Test b.Grouping Variable: Agro-climatic zone
	%	10	34	66	***100***	

Influence of flooding have Significance difference across agro-climatic zone at (x^2, $p<0.05$)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

The voting of household respondents for high level flood storm influence in kola areas was (72.2%) that followed by dega (62.5%) and woinadega (42.9%) agro-climatic zone respectively (table 8) .The test result from Kruskalwallis statistical calculation showed that level of flood storm influence on crop production was high in kola climatic zone areas significantly ($P<0.05$) higher than flood storm influence in dega and woinadega areas (table 8). Interviewed household and focus group discussion members ascertained that vegetation cover, nature of the topography and human intervention in kola area is responsible for high risk of flood on the crop. The researcher also observed that kola area is full of cliff (sirti local name), valley (sulula in local name), hills and steep landscape that exposed to flood more than the other area. Relatively dega and woinadega is gentle slope that rarely exposed to the high level of the flood storm. These simply indicate that crop production in kola area is more vulnerable to flood storm than the other zone in kuyu woreda. From this discussion, the researcher understand that the negative impact of the flood on crop is high in kola that followed by dega and woinadega respectively in kuyuworeda.

E. Hail storm

According to Nicolaides K.A (2009) finding, hail is a harmful weather element that can cause considerable damage to crop production. Hence, the impact of hail on the crop is directly related to its severity. In the view of this Changnon et al (2009) indicated that the amount of crop loss per storm event is based on the frequency of hail, the size of the hailstones that fall, the number (volume) of hailstones that fall and the speed of the wind when hail falls. In fact, nobody was fallowing the nature of the hail rather than observing the impact level of hail on the crop in kuyu woreda and also it is out of scope of this study. Accordingly, household respondents realized that hail was one among physical factor that damaged crop in their locality in general (table 9).

Table 9.the influence of the hailstorm on crop production in the kuyuworeda (N=100)

Agro-climatic zone	Influence of the hailstorm on crop production					Kruskalwallis test result
		Low	Medium	High	Total	Test Statistics(a)((b)
Dega	N	3	12	25	40	Normalized residual Chi-Squar______2.238 df _________ 2 Asymp. Sig._0.327
	%	7.5	30	62.5	100	
Woinadega	N	6	24	12	42	
	%	14.3	57.1	28.6	100	
Kola	N	0	16	2	18	
	%	0	88.9	11.1	100	
Total	N	9	52	39	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone
	%	9	52	39	100	

Influence of the hailstorm have no significance difference across agro-climatic zone at (x^2, p>0.05 *(Hint: N- represents number of household respondents)*

Source: Field survey, 2015/6

The summarized data in the table 9 revealed that about 62.5% of dega household respondents felt high negative impact of hail on the crop that followed by 28.6% and 11.1% household respondents in woinadega and kola agro-climatic zone respectively. But, Kruskal Wallis test result presented on table 9, indicated that with a significance level of 0.327 which is greater than 0.05, the voting by the household respondents across agro-climatic setup (dega, woinadega and kola) of study area on the impact level of hail storm on crop production is not statistically significantly different. Statistically identified uniformity among the dega, woinadega and kola agro-climatic zone of the woreda regarding influence of hail storm on the crop production indicate that hail storm is not one agro-climatic zone limited in the woreda. Koriri k (2011) finding indicated that farmers are threatened against crop losses caused by hail storm. Similarly, the researcher found that hail was one of the critical factor that damaging crop in the study area. This all reveal that hail was damaging crop throughout agro-climatic setup of kuyuworeda.

F. Frost storm

According to FAO (2005) report, frost damages the crops since the first crops were cultivated. This report also indicates that one night of freezing temperatures can lead to complete crop loss. This shows how far the frost harms crop production and productivity. Consistently, data generated from the household respondents showed that frost was critical problem to crop production in kuyu woreda (table 10).

Table 10. The influence of the frost storm on the crop production in the kuyuworeda (N=100)

Agro-climatic zone	Influence of the frost storm on the crop production								kruskalwallis test result
	Low		Medium		High		Total		Test Statistics(a)((b)
	N	%	N	%	N	%	N	%	
Dega	2	5	1	37.5	23	57.5	40	100	Normalized residual Chi-Squar__0.771 df ________ 2 Asymp. Sig._0.680
Woinadega	7	16.7	20	47.6	15	35.7	42	100	
Kola	4	22.2	11	61.1	3	16.7	18	100	
Total	13	13	46	46	41	41	100	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone

Frost storm have no significance difference across agro-climatic zone at (x^2, p >0.05)
(Hint: N- represents number of household respondents)

Source: Field survey, 2015/6

Laterally, frost pressure on crop production was different across agro-climatic zone (dega, woinadega and kola) of the study area as shown in table 10. In dega areas 57.5% of household respondents felt as frost causes crop failure as compared to woinadega (35.7%) and kola (16.7%) agro-climatic zone of the woreda respectively. These indicate that household respondents in each agro-climatic classification felt frost pressure differently according to their agro-climatic setup.

However, Kruskal Wallis statistical test result contradicts this statement. Thus, Kruskalwallis statistics calculated for this purpose was determined that there was no statistically significantly difference across agro-climatic setup of kuyuworeda's household respondents in voting for impact of frost that cause crop production failure in the area. From this one can understand that frost was severe problem of dega, woinadega and kola climatic setup that causes crop production failure. But, as Degeffa T (2005) study in kamise zone indicate, negative impact of frost on crop production is limited to high altitude areas. Anyway, the researcher finding indicate that frost storm is seasonal limited than altitudinal limited in kuyuworeda. Accordingly, most household informants and focus group discussion members also realized that the damage of the frost to the crop was observed from about mid of September to October in dega, woinadega and kola agro-climatic setup of the kuyuworeda. Once crops are attacked by frost, it is simply left for caws as fodder.

G. Pest pressure

Table 11The influence of the crop pest on the crop production in the kuyuworeda (N=100)

Agro-climatic zone	Influence of the crop pest on the crop production								kruskalwallis test result
	Low		Medium		High		Total		Test Statistics(a)((b)
	N	%	N	%	N	%	N	%	Normalized residual Chi-Squar___1.897 df_________2 Asymp. Sig._ 0.387
Dega	10	25	16	40	14	35	40	100	
Woinadega	8	19	17	40.5	17	40.5	42	100	
Kola	11	61.1	4	22	3	16.7	18	100	
Total	29	29	37	37	34	34	100	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone

Crop pest have no significance difference across agro-climatic zone at (x2, p >0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

In woinadega areas about 40.5% of household respondents were felt high pest damage to crop as compared to dega and kola with 35% and 16.7% respectively (table 11). To justify this, test of significant difference among groups of households that vote for pressure of pests on crop in dega, woinadega and kola was made as summarized in Table 11. Accordingly, with the 0.05 level of significance, Kruskal Wallis test result (x2= 1.897, p=0.387) shows that there was no statistically a significant difference among household respondents' of dega, woinadega and kola agro-climatic setup of the kuyuworeda. Even at 0.10 significant levels, there was no statistically significant difference in the voting of household respondents for the pest pressure on crop production across agro-climatic setup of the area. This shows that pests was nearly equally harming crop in any agro-climatic setup of the area in general. The negative impact of pest on the crop production in kuyuworeda is similar to Barker .K.R and Sorenson C, (2003) finding. According to their finding, the crop pest is most damaging crop once it happened.

H. Weeds pressure

It was expected that weeds caused considerable loss of crop. Consistently, Reddy K.N. (2012) finding indicated that effects of weeds on crop yields are unquestionable because weeds cause significant crop losses in each year. Similarly, the researcher found that weeds were causing crop production failure in the kuyu woreda. Data summarized from household respondents in the table 12 below realized above discussion.

Table 12the influence of the weeds on crop production in the kuyuworeda (N=100)

Agro-climatic zone		Influence of the weeds on crop production				Kruskalwallis test result
		Low	Medium	High	Total	Test Statistics(a)((b)
Dega	N	8	12	20	40	Normalized residual Chi-Squar___2.522 df_________2 Asymp. Sig._0.283
	%	20	30	59	100	
Woinadega	N	10	14	18	42	
	%	23.8	33.3	42.9	100	
Kola	N	12	6	0	18	
	%	66.7	33.3	0	100	
Total	N	30	32	38	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone
	%	30	42	38	100	

Influence of the weeds have no significance difference across agro-climatic zone at (x2, p>0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

Cross –arrangements of household responses to agro-climatic zone presented in table 12 above shows, the household response regarding the crop production failure that caused by weeds across agro-climatic setup. Accordingly, crop producers of dega (59%) felt high crop damaged by weeds than woinadega (42.9%) and kola (0%) agro-climatic setup. In another way, table 12 depicted that none of kola's the sample households reported their crop was highly damaged by weeds. These indicate that the negative influence of weeds on crop production was varying throughout agro-climatic setup of the area.

However, result from Kruskal Wallis statistical calculation (x2=2.522, p=0283) revealed that there was no significant difference at p=0.05 and even 0.10 significance level among group of household responses to influence of weeds on crop production throughout dega, woinadega and kola agro-climatic division of the study area. Nearly equally, crop production in dega, woinadega and kola agro-climatic zone was affected by weeds. These indicate that weeds severely affected crop in kuyu woreda. Similarly, Kostov T and Pacanoski Z (2007) have found that weeds are the main limiting factors in profitable crop production as the presence of weeds is relatively constant. From this all, one can understand that weeds were one among the other critical factor that causing crop production failure in the study area.

Socio-economic cause for crop production failure:-

Fekadu N (2008) indicate that the availability of sufficient labor, animal power, and farming inputs are playing a pivotal role for crop production status of the household . Hence, the crop production status of the household is expected to be progressing with availability of aforementioned factor than lowering or nothing of these factors. The researcher also found that these factors were causing crop production failure in the study area as discussed here under. To see if there was significance deference among dega, woinadega, and kola agro-climatic zone of the area, Kruskal Wallis statistical calculation was used as follows.

I. Draft animals

Table13. The availability condition of draft animals in the kuyuworeda (N=100)

Availability of draft animals	Agro-climatic zone								kruskalwallis test result
	dega		woinadega		kola		Total		Test Statistics(a)((b)
	N	%	N	%	N	%	N	%	Normalized residual Chi-Squar__0. 347 Df_________2 Asymp.Sig__ 0.841
adequate	24	60	23	54.8	17	94.4	64	64	
sometimes in adequate	11	27.5	8	19	1	5.6	20	20	
always inadequate	5	12.5	11	26.2	0	0	16	16	
Total	40	100	42	100	18	100	100	100	a. Kruskal Wallis Test b. Grouping Variable: Agro-climatic zone

Availability of draft animals have no significance difference across agro-climatic zone at (x^2, p>0.05)

(Hint: N- represents number of household respondents)

Source: Field survey, 2015/6

As indicated in table 13, about the 94.4% of kola's household respondents felt the availability of the draft animals that followed by 60% in dega and 54.8% in woinadega agro-climatic setup of the area. But, Massay (2011) indicate that animal power is inadequate and even the existing draft animal is inefficient for farm in kuyu woreda. Thus, this high proportion of household respondents felt to adequacy of the draft animal power is not due to adequacy of draft animals at each household level but it is due to best social teamwork they have and hoeing practice they developed. This indicates that best social teamwork they formed and hoeing practice they developed enable them to forget the negative impact of the draft animals on crop production. In another way, the above table shows, 26.2% of woinadega household respondents were felt the crop failed due to extreme inadequacy of draft animals. When Kruskal Wallis statistics was calculated to test if any statistically significant difference in the voting of household respondents for availability of draft animals across agro-climatic setup of the area (x^2 = 0. 347, ρ = 0.841), no statistically significant difference was found among dega, woinadega and kola agro-climatic zone of the area (table 13). From this, the researcher understands that the draft animal unavailability that causes crop production failure was fairly similar throughout dega, woinadega and kola agro-climatic setup of the area.

II. Farming labor

Table 14. The availability of the farming labor in the kuyuworeda (N=100)

Agro-climatic zone	availability of farming labor				
		adequate	Sometimes inadequate	always inadequate	Total
Dega	N	19	16	5	40
	%	47.5	40	12.5	100
Woinadega	N	16	13	13	42
	%	38.1	31	30.9	100
Kola	N	0	10	8	18
	%	0	55.6	44.4	100
Total	N	35	39	26	100
	%	35	39	26	100

Kruskalwallis test

Test Statistics(a) (b)

Normalized residual
Chi-Squar__ 2.707
Df______2
Asymp.Sig__ 0.258

a. Kruskal Wallis Test
b. Grouping Variable: Agro-climatic zone

Availability of farming labor have no significance difference across agro-climatic zone at (x2, p>0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

Table 14 above shows that always kola's household respondents did not felt the availability of the farming labor for crop production than the dega and woinadega climatic zone. This indicated that household respondents of kola, woinadega and dega agro-climatic zone was felt the adverse impact of farming labor on crop production. But the inadequacy of farming labor variation across agro-climatic zone of the kuyu woreda was not statistically significant difference. Kruskal Wallis test result (x^2=2.707, p=0.258) showed that there was no significant difference at (p=0.05) significance level among group of household responses to situation of farming labor impact on crop production throughout dega, woinadega and kola agro-climatic zone of the study area. This outcome shows that the shortages of farming labor adversely affect crop production in every agro-climatic setup of the area in a very similar atmosphere. The finding of the Wilhemina (2008) also supports this idea.

Most informants revealed that crop production process in kuyu woreda was totally depending on the extensive human labor. So, about 100(39%) and 100(26%) sampled household respondents from selected kebeles of kuyu woreda felt that farming labor was sometimes inadequate and always inadequate for crop production respectively. Thus, from this one can understand that unavailability of farming labor highly affect crop production as it happens. Consistently, the finding of TAWS, (2004) and Devendra, et al (1997) indicated that many developing regions, especially sub-Saharan Africa are highly dependent on extensive human labor for crop production. Thus, the unavailability of human labor highly reduces crop production in this region. So, the unavailability of farming labor was causing crop production failure in kuyu woreda.

III. Availability of farming inputs

Table15. The situation of farming inputs in the kuyu woreda (N=100)

Agro-climatic zone	Situation of farming inputs							
	adequate		sometimes inadequate		always inadequate		Total	
	N	%	N	%	N	%	N	%
Dega	18	45	12	30	10	25	40	100
Woinadega	19	45.2	7	16.7	16	38.1	42	100
Kola	0	0	0	0	18	100	18	100
Total	37	37	19	19	44	44	100	100

kruskalwallis test result

Test Statistics(a)((b)

Normalized residual
Chi-Squar___2.031
Df_________2
Asymp.Sig_0.362

a. Kruskal Wallis Test
b. Grouping Variable: Agro-climatic zone

Availability of farming inputs have no significance difference across agro-climatic zone (x^2, p>0.05)

*(Hint: **N**- represents number of household respondents)*

Source: Field survey, 2015/6

Table 15, above display that about 100% of kola crop producers faced farming inputs shortage always, that followed by woinadega(38.1%) and dega(25%) agro-climatic setup of the study area. This indicates that kola agro-climatic setups of the area were faced crop production failure due to shortage of farming inputs.

Kruskal Wallis statistical calculation result was used to assured whether there was significant difference among dega, woinadega and kola agro-climatic setup of the area concerning the voting of household respondents for availability of farming inputs for crop production. The Kruskal Wallis statistical test result showed that there was no statistically significantly difference(x^2= 2.031, p= 0.362) even at 0.10 significant level among dega, woinadega and kola household voters for influence of farming inputs on crop production. This indicates that farming input related crop production problem was nearly similar across agro-climatic setup of the area understudy. This gave the way for the researcher to saw household respondents' reflection from different agro-climatic setup as exclusive concerning impact of farming inputs on crop production. As summarized on table 15, about 44% of 100 total household respondents fingered that farming inputs was inadequate always that harms crop production and productivity in the area. Similarly most interviewed household and focus group discussion members thought, most common farming input like high yielding crops variety, fertilizer and herbicide was inaccessible to their area due to the following reason, 1st low buying capacity of the farmer , 2nd delaying of farming inputs at time it required for farming activities and 3rd low delivery of farming inputs. From this one can conclude that crop production hampered due to inadequacy of farming inputs to crop producers in the study area.

Conclusion and recommendation:-

Conclusion:-

The following conclusions can be drowning from the present study on determinants of crop production failure in the kuyu woreda. Accordingly, in this study area, the level of crop production failure was high. For this high level of crop production failure, the researcher was able to reach on number of indicators. Thus, low level of household satisfaction to crop production, crop produced/harvested below expectation of peasants, aggregate of household meeting crop failure and declining of crop production in kuyu woreda were identified to indicate the presence of crop production failure in the kuyu woreda.

It was already identified that biophysical and socio-economic factors like temperature, rainfall, drought, hailstorm, frost storm, pests, weeds, flood, unavailability of farming labor, unavailability of draft animals and farming inputs were causing crop production failure in the kuyu woreda. For better understanding, the Kruskal Wallis statistic was calculated to determine whether there was any statistically significant difference for each of identified key biophysical and socio-economic factors on causing crop production failure throughout dega, woinadega and kola agro-climatic setup of the kuyu woreda. Accordingly, except flooding, all factors aforementioned were not statistically significance difference among dega, woinadega and kola agro-climatic setup in causing crop production failure in the study area. In any of agro-climatic zone of kuyu woreda, these identified factors were causing crop production failure currently. Generally, temperature, rainfall, drought, hailstorm, frost storm, pests, weeds, flood, shortage of farming labor, shortage of draft animals and farming inputs were causing crop production failure in the kuyu woreda.

Recommendation

The following points are recommended for the future based on the researcher understanding from whole section of the study.

Surveys for this study reveal that most dominantly known crops like sorghum, teff and barley were collapsed in kuyu woreda. But as MoFED (2006), report indicated, north shoa zone (kuyu woreda is located in) is identified as crops growth corridor for its comparative advantages. Therefore, great attention should be given for this woreda to enhance crop production as vital as expected.

The discussion in the preceding sections indicates that crop producers of the kuyu woreda were facing crop production failure due to drought, extreme temperature, flooding, hail storm, frost storm and rainfall extreme. It is clear that these factors are weather extremes. Thus, crop producers should access to local based information about these weather extremes through mobile SMS, radio and the like on the time necessary.

The study indicates that weeds and pests were causing crop production failure in the kuyuworeda. Hence, attempt should be made to access the crop producers to pesticide, herbicide and to any other managing system by nearby concerned body.

In this research, it was indicated that most common farming input like high yielding variety crops and fertilizer was inaccessible to crop producers due to low buying capacity of the farmer, delaying of farming inputs at time it required for farming activities and low delivery of farming inputs. Thus, crop production was failed. Therefore, the woreda's agricultural office should pay attention on the provision of these farming inputs on time required with amount desired.

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