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Discovering Thoughts, Inventing Future

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The Feasibility of using Natural Rocks as Sources of Zinc and Cobalt Inlivestock Feeding in Ethiopia

By Abegaze Beyene & Anne Lelacheur
Jimma University, Ethiopia

Abstract- In Ethiopia, feed industries are widely using limestone as a cheap source of Ca without adequate information on the bioavailability of its Ca content and the presence of useful minerals and toxic minerals as well. This being the case, the present study was conducted to determine the Zinc and Cobalt content of samples of limestone, Gypsum and marble powder collected from different parts of Ethiopia. Adequate quantities of lime stone, marble powder and gypsum were procured from different parts of Ethiopia and subjected to laboratory chemical analysis in triplicate. The results of this study clearly showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99%, indicating the potential use of these materials (limestone, marble powder and gypsum) collected from different part of Ethiopia as supplementary mineral feed source in very small amounts. In present work the Zn content of the lime stone ranged (ppm) 18.4--50.8(with an average of 28.8),In marble powder ranged 16.3—58.88 (with an average of 37.59) and in that of Gypsum from Mugger cement was containing (an average of 10.87 the value of which was almost similar with the Zn content of Calcium-carbonate and calcite powder(21.33 ±1.20) and(37.50± 2.39%) respectively, showing that Zn content in gypsum of the present study is a beat lower than the content of limestone, marble powder and Calcite powder.

Keywords: *gypsum powder, lime stone, livestock, marble powder, minerals.*

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The Feasibility of using Natural Rocks as Sources of Zinc and Cobalt Inlivestock Feeding in Ethiopia

Abegaze Beyene [α] & Anne Lelacheur [σ]

Abstract- In Ethiopia, feed industries are widely using limestone as a cheap source of Ca without adequate information on the bioavailability of its Ca content and the presence of useful minerals and toxic minerals as well. This being the case, the present study was conducted to determine the Zinc and Cobalt content of samples of limestone, Gypsum and marble powder collected from different parts of Ethiopia. Adequate quantities of lime stone, marble powder and gypsum were procured from different parts of Ethiopia and subjected to laboratory chemical analysis in triplicate. The results of this study clearly showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99%, indicating the potential use of these materials (limestone, marble powder and gypsum) collected from different part of Ethiopia as supplementary mineral feed source in very small amounts. In present work the Zn content of the lime stone ranged (ppm) 18.4--50.8(with an average of 28.8),In marble powder ranged 16.3—58.88 (with an average of 37.59) and in that of Gypsum from Mugger cement was containing (an average of 10.87 the value of which was almost similar with the Zn content of Calcium-carbonate and calcite powder(21.33 ±1.20) and(37.50± 2.39%) respectively, showing that Zn content in gypsum of the present study is a beat lower than the content of limestone, marble powder and Calcite powder. The Cobalt content of limestone ranged (ppm) 205.13---249.87(with an average of 238.2),the cobalt in marble powder is 249.4 and the cobalt in gypsum is 248.8,showing cobalt content of the present stud is almost equal in all the three samples (limestone, marble powder and gypsum)

In summary the results of this study showed that lime stone and marble powder widely available in different parts of Ethiopia seems to have potential value as Zn and Co supplement for livestock feeding. Testing the bioavailability of these materials with animal and identifying other toxic minerals seems to be the future direction of research.

Keywords: gypsum powder, lime stone, livestock, marble powder, minerals.

I. Introduction

Successful animal production depends on genetic and environmental factors including nutrition and management practices. Of which nutrition plays an important role. It is believed that more than 50% of the farm expenditure or cost of animal production goes towards feeding of animals. Dietary nutrients promote programming and expression of the metabolic pathways that enables the animal to achieve its genetic production potential. All the nutrients (carbohydrate, proteins, fat, vitamins, and minerals) are equally important as deficiencies of one or more of these nutrients hamper the health status and productivity level of animals. Minerals may constitute a small fraction of the total ration but perform vital role in the body.

There is variation in the mineral content of different animal tissues. The concentrations of essential elements must usually be maintained within the narrow limits, if the functional and structural integrity of the tissues is to be safeguarded and the optimum growth, health and productivity status of the animal are to be maintained. Continuous ingestion of diets that are deficient, imbalanced or excessively high in a mineral, induce change of the normal mineral concentration of body tissues. In such circumstances the biochemical and physiological functions of the animals are affected which in turn may result in structural disorders. The developed structural disorders are variable with the mineral element concerned and its toxicity, the degree and duration of dietary deficiency, and the age, sex and species of animal involved Chesters and Arthur,(1988) Such a change could be prevented through the provision of balanced, palatable and adequate diet in desirable forms. According to McDowell et al (1993) mineral supplements differ in their bio-availability, one of the most important factors in mineral nutrition, which must be taken into consideration. Thus it is necessary to comparatively scan the available mineral supplements aimed at ensuring its adequacy and levels of toxicity incriminating minerals. This being the cases, the major objective of this research project was to study the feasibility of using natural rock as potential source Calcium and other mineral in livestock feeding in Ethiopia. Keeping the above in view the present study was carried out

To study the content of zinc and cobalt in calcium carbonate ($caco_3$) or limestone, Marble powder and gypsum obtained from different locations of Ethiopia (natural sources, cement factories etc.)

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II. Materials and Methods

a) Collection of samples

For this study certain samples of calcium carbonate or lime stone with two samples of marble powder which was wet and dry, one sample of gypsum and one sample of silica powder were procured from different sources/ locations (Efforts were made to procure as many batch samples as possible. The detail is given in table 2.1.

b) Analysis of samples

The samples that had been collected from various sources were analyzed in triplicate for dry matter (DM), total ash, acid insoluble ash (AIA), Zn and Co as trace minerals.. Total ash and AIA were analyzed by the method of AOAC (2002). Zn and Co as trace minerals were analyzed using AAS (Atomic Absorption spectrophotometer) AOAC. (2002).

Table 2.1 : Sources of calcium carbonate

Sr. No.	Date Of Collection	Name of Sample	Place of Collection
1	17/07/2013	Marble powder(wet)	Addis marble factory
2	17/07/2013	Marble powder (dry)	Addis marble factory
3	17/07/2013	calcium carbonate	Amhara (Gojam) filiklik Abyssinia cement factory
4	17/07/2013	calcium carbonate	Amhara (North showa) Jamma Abyssinia cement factory
5	17/07/2013	gypsum	Amhara(Go jam) filiklik
6	17/07/2013	calcium carbonate	oromia (Durba) Mugger cement factory
7	17/07/2013	silica powder	oromia (Durba) Mugger cement factory
8	17/07/2013	calcium carbonate	oromia (Durba) Durban cement factory
9	18/07/2013	calcium carbonate	Hungshan cement factory Mojo Hirnna (Harar)

c) Analytical procedures

i. *Processing of minerals supplement samples*

1 gm of dried mineral supplements sample were taken in silica basin and charred to remove smoke and ashed at 550°C in a muffle furnace for two hrs. Acid extract was prepared by quantitative transfer ash to a dried clean glass beaker to which 20 ml of 5 N HCl was added this was boiled for 5 minutes and filtered through what man filter paper No. 42 into 250 ml volumetric flask. The filter paper was washed with hot distilled water until free of acid; the volume was made to the mark with distilled water. This extract was used for analysis of, Zn, Co, Pb and Cd.

ii. *Estimation of Zn, Co,Cd and Pb*

Minerals (Zn, Co, Pb and Cd) will be estimated by atomic absorption spectrophotometer (AAS) using acetylene as fuel and air as oxidant, specific hallow cathode lamps were used for the determination of each element. After adjusting the instrument, the standards and unknown will be monitored through the samples spraying device to get the constant reading in the digital display The detail of preparation of standard solutions for various elements is shown in table2.2.

Table 2.2 : Preparation of standard solutions for zinc and cobalt

Element	Salt	Quantity in mg will be made to 100 ml distilled water	Yield	Standard range
Zinc	ZnSo4.7H2O	44.235	100 ppm	0.4—2 ppm
Cobalt	CoSo4. 7H2O	49.17	100 ppm	1.6—16 ppm

Stock solution containing 100 ppm of .Zn and Co were prepared by taking the accurately weighed amount of each salt and making the volume as indicated in table2.2.

III. Results and Discussion

Total Ash and Acid Insoluble Ash

The total ash, AIA, Zn and Co contents of the limestone, marble powder, gypsum and silica collected from different part of Ethiopia are given in Table 3. According to Kabaija and Little (1993), the total ash content of most of the Ethiopian common animal feed is equal or lower than 12%. Total ash content of 10-12% and 4.6-8.7% was reported from range grasses and highland hays of Ethiopia respectively. The highest total ash content of 12% was reported from Chrysopogon *aucheri* grown in the highland of Ethiopia. According Table 3, total ash content of 99% was recorded from Addis Marble powder, Jamma Limestone (Abyssinia Cement), Durban Silica Mugger Cement, Durban limestone cement and from Hirna limestone hungshan cement factory, the value of which is very high compared to the others. The lowest total ash content of 81% was recorded from Durban Gypsum cement. The results of this study clearly showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99% (on dry matter basis), indicating the potential use of these materials (limestone, marble powder and gypsum collected from different part of Ethiopia) as supplementary mineral feed source in a very small amounts.

Acid Insoluble Ash content of animal feed seems to receive adequate attentions. The BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability. Ammerman et al (1984) reported that high levels of AIA in the ration of livestock depressed the utilization of P and certain other micronutrients. Kabaija and Little (1993), reported ADF ash content of 3-5% from common Ethiopian animal feeds. ADF ash content of range grasses ranged between 4.06 and 7.61%. It is reported that high levels of ADF ash in animal feed negatively affect digestibility. It is also reported that the high levels of ADF ash in animal feed could be attributed to the presence of large amounts of silica which in turn may seriously reduce digestibility *Van Soest* (*1982*) .The result of this study showed that Durban Silica Mugger Cement contain 96 % Acid Insoluble Ash which makes it unfit as animal feed because of its insolubility. Jamma limestone, Durban gypsum Mugger and filiklik limestone Gojam contain 4.2-8.3% Acid Insoluble Ash, the values of which are high for the use as animal feed compared to the others. On the other side (Table 3) the Acid Insoluble Ash content of the others (Limestone Abyssinia cement factory(Jamma), Limestone Durban cemnt factory (Durba), Limestone Hungshan cement factory (Hirna)) ranged between 0.29 and 3.29%, the values of which are lower than that reported from the Ethiopian highland range grasses and straw based dry period roughage feeds. Therefore, the results of this study clearly showed that Limestone from durba, Limestone (Jamma) and Limestone (Hirna) could be used as mineral supplant in livestock feeding based on their percent composition of Acid Insoluble Ash.

Table 3. : Total ash, AIA(on percent DM basis)and trace minerals content in gypsum, lime stone and marble powder (ppm)

SAMPLE N0	Places of collections	DM %	AIA % of DM	Total ash	Zn ppm	Co ppm
1	Marble powder wet *Addis marble factory	99.73	1.09	99.31	16.13	249.39
2	Marble powder dry *Addis marble factory	99.78	1.33	99.39	58.88	249.43
3	Lime stone Gojam (Filiklik)*Abyssinia cement factory	0.08	8.29	97.12	22.27	239.54
4	Limestone Abyssinia cement factory(Jamma)	99.73	3.27	98.69	50.79	249.38
5	Limestone Abyssinia cement factory(Jamma)*	82.07	4.24	77.16	18.38	205.13
6	Gypsum Mugger cement factory (durba*)	99.49	8.43	97.27	10.87	248.79
7	silica Mugger cement factory (durba)*	99.96	95.72	99.58	29.04	250.05
8	Limestone durban cement factory (dubra)*	98.40	0.29	97.70	29.04	246.88
9	Limestone hungshan cement factory (Hirna)*	99.89	3.29	99.20	23.50	57.83

*N.B, * Wet, –While cutting the marble in the factory they are pouring water (wet)*

**Dry- While cutting the marble in the factory without pouring water (dry)*

** This are local names where the respective factories are taking the row materials (lime stone, gypsum or marble powder*

7. Silica cannot be used as feed its content is analyzed just for curiosity only.

Limestone and calcium carbonates are the same *a) Zinc (Zn)*

Zinc concentration in browses ranged from 38.1 to 171 ppm with a mean of 73.6±6.08 ppm in the wet season and 14.3 to 130 ppm with a mean of 56.7±6.08 in the dry season. In the dry season,10% of the sampled browses contained below the recommended (McDowell and Arthington 2005) concentration for ruminants. Mean concentration of Zn in sampled browses were higher than the critical level for ruminants in both the wet and the dry seasons indicating adequate concentration of Zn in forages for different classes of camels. Higher concentration of Zn was obtained in the wet season compared to the dry season. Mtimuni et al (1990) also reported a variation on Zn concentration of forages with high concentration in wet seasons in Malawi.

McDowell *et al* (1978) considered 30 mg/kg to be a critical level of dietary Zn, although the ARC (1980) has suggested that concentrations of 12-20 mg/kg are adequate for growing cattle. The crop residues may thus constitute a marginal supply of Zn; the necessity for supplementary Zn needs to be kept under review particularly for sheep, which require some 35 mg Zn/kg diet (ARC, 1980). Nutrient quality of forages in Ethiopia with particular reference to mineral elements E. Kabaija and D.A. Little International Livestock Centre for Africa P.O. Box 5689, Addis Ababa, Ethiopia P.O. Box 5689, Addis Ababa, Ethiopia.

According to the result of this study (Table 3), Zn content in marble powder ranged (16.13—58.88ppm) with an average of 37.5 which is better than what the browses spices are getting specially in dry season and better than from what Mc Dowell mentioned 12—20 mg/kg which is enough for growing cattle Zn in lime stone ranged (22.27---50.79ppm) with an average of 28.8ppm which sill enough for supplementing most of the live stock's. Zn in gypsum analyzed is 10.87 which is very low. Where the AIA is <3.5% the material can be used confidently but if it is >3.5% AIA it is difficult to use according The BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability.

b) Cobalt (Co)

Most forages and feedstuffs fed to dairy and beef animals do not contain adequate quantities of cobalt to support the rumen and animal requirements. Consequently supplemental cobalt must be added to beef and dairy rations. Common acceptable sources of cobalt include: cobalt carbonate; cobalt sulfate; cobalt chloride and cobalt gluco heptonate (Henry, 1995). Cobaltous oxide is not an acceptable source of cobalt, as it has low bioavailability relative to the aforementioned sources (Henry, 1995). Cobalt propionate may be a slightly better source of cobalt compared to cobalt carbonate. Steers supplemented with 0.10 ppm of cobalt as cobalt-propionate had higher plasma glucose and ruminal propionate concentrations then those steers receiving 0.10 ppm cobalt from cobalt carbonate. However, average daily gains were not significantly different between the two cobalt sources (Tiffany, et al, 2003).

The National Research Council (NRC) cobalt requirement for dairy cattle is 0.11 ppm and 0.10 ppm for beef cattle. There is evidence that dietary cobalt concentrations exceeding the NRC requirements may have further beneficial effects on both ruminal bacterial activity and animal performance. In situ dry matter digestion of alfalfa hay, corn cobs, corn leaves and corn stalks were all improved when incubated in the rumen (via porous Dacron bags) of non-lactating cows supplemented with cobalt at 2.5 times the NRC requirements compared with cows not supplemented with cobalt (see Table 1;Lopez-Guisa and Satter, 1992).

In a lactating dairy cow study conducted at Washington State, fat-corrected milk production was improved with mature cows but not first calf heifers, when cobalt

The NRC (2001) requirement for Co is set at 0.11 ppm of dietary DM (approximately 1.2 mg/day for a dry cow and 2.4 mg/day for a lactating cow).Cobalt concentration in Some Selected Acacia Species in lowlands of Ethiopia ranged from 1.6—2.6 mg/kg dm with an average of 2.3 mg/kg DM (Gebeyew, et al., 2015) which can fulfill the requirements of browse animals or animals having access to acacia species in lowlands parts of Ethiopia.

According to the result of this study (Table 3) in samples 1,2,4,8,9 ranged 23.5—249.43 ppm with an average of 203.6 ppm, Thus an average of I kg studied sample can support 169 dry and 84 lactating cows /day.

Sample 3,5,6 are not taken into account because if AIA is >3.5% The BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability and sample 7(Table 3)cannot be used as animal feed just done **for curiosity only.**

IV. Conclusions

Samples of lime stone powder ($CaCo_3$) powder were collected from different parts of Ethiopia were subjected to laboratory chemical analysis in triplicates. The results obtained showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99% (on dry matter basis), indicating the potential use of these materials (limestone, marble powder, gypsum and silica collected from different part of Ethiopia) as supplementary mineral feed source in a very small amounts. The Acid Insoluble Ash content of limestone from Abycinia, cement factory (Jamma), Limestone Durbacemnt factory.(Durban), Limestone Hungshan cement factory (Hirna)) ranged between 0.29

and 3.29%, the values of which are lower than that reported from the Ethiopian highland range grasses and straw based dry period roughage feeds. Therefore, the results of this study clearly showed that - Limestone from durba, Limestone(Jamma) and Limestone(Hirna) could be used as mineral supplant in livestock feeding based on their percent composition of Acid Insoluble Ash. According to the results of this study, the(AIA) Acid Insoluble Ash content of limestone from Gojam (Filiklik)*Abyssinia cement factory and Gypsum Mugger cement factory (durba*)is very high those samples coudnot be used as mineral supplement as BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability The results obtain showed that the content of the test materials are comparable to that of the common Ethiopian animal feed stuffs. However, animal evaluation of the bioavailability of the test materials seems to be the future direction of research.

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Assessment of Livestock Production System and Feed Resources Availability at Melka Watershed of Nile Basin, Jeldu District, Western Ethiopia

By Zewdie Wondatir

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Abstract- A rapid assessment on the livestock feed resource availability and livestock production system was undertaken to identify main livestock production constraints and come up with possible intervention strategies in the Melka watershed area of the Nile basin. The watershed was chosen for its strategic representation and accessibility. Three villages (Abeyi, Bore'a and Dini) were selected for the study from Melka watershed area of Jeldu district. A total of 45 participants were selected from the three villages for the Participatory Rural Appraisal (PRA) and individual interviews. The FEAST excel macro program (www.ilri.org/feast) was used for data summary and analysis. Livestock production in the study area is mainly based on production of indigenous livestock breeds, with the exception of Bore'a village, where some farmers keep crossbred dairy cattle. Livestock serve as sources of draught power and manure for crop production, and sources of meat, milk and eggs and as sources of cash income. However, the productivity level of the livestock resources was indicated to be very low.

Keywords: *crop residues, grazing pasture, village, households*.

GJSFR-D Classification : *FOR Code: 079901*

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Keywords: crop residues, grazing pasture, village, households.

I. Introduction

Mixed crop livestock production system is the major component of agricultural practices in the highlands of Ethiopia. Cattle produce much more than food in smallholder production system as source of power for cultivation, milk, meat and direct cash income. In the mixed crop-livestock production system of the highlands, crop residues are the major feed resources for ruminant livestock. Thus, availability and quality of these feed resources shall govern the fate and sustainability of ruminant livestock production in the mixed crop-livestock production system. Studies in the central highlands of Ethiopia also indicated that the respective contribution of pasture area to total feed supply was in the range of 20-30% while the contribution of crop residues and aftermath grazing was 70-80% (Tadesse et al 2009). Moreover, progressive decline of average farm sizes in response to rising human populations, encroachment of cropping land onto erstwhile grazing areas and onto less fertile and more easily erodible lands, and expansion of degraded lands, which can no longer support either annual crops and pastures contributes to shortage of feed resources (Alemayehu 2005). However the production and productivity of livestock in different parts of the country is low due to multidimensional constraints. Among the numerous bottlenecks, shortage of feed supply and poor nutritional quality of available feed resources are the major constraints affecting livestock productivity (Adugna et al 2012). Moreover, livestock feed problem is more intense in the highlands of the country where more than 75% of both the human and livestock population are concentrated. However current baseline information is lacking with regard to livestock feed resource availability in the Melka watershed of the Nile basin. Thus, this study was carried out with the aim of rapidly assessing the prevailing farming and livestock production system, feed resources availability and livestock production constraints of the area in order to identify potential intervention strategies for the development of livestock feed resources and natural resource management.

II. Methodology

a) *Main features of the study area*

Jeldu district is located at 09 15' 54.9" N and 038 04' 54.4" E, approximately 115 km west of Addis Ababa in West Shewa Zone of Oromia Regional State. It has an elevation range of 2500 – 3200 meter above sea level (masl). The district has a total area of 139, 389 hectares with variable agro ecology of high lands (45%),

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midlands (30%) and lowlands (25%). According to the key informants, average land holding in the district is 2 hectare per household.

Three villages were selected from Melka watershed area of Jeldu district. The watershed was chosen for its strategic representation and accessibility. Accordingly, Abeyi, Bore'a and Dini villages were selected for the study. These study sites are part of Melka watershed, which is one of the main spot for Nile Basin Development Challenge (NBDC) pilot project.

b) Sampling and data collection methods

The selection of villages was conducted by representatives of the technical group members at the District Office of Agriculture and Livestock. The three villages were selected purposively based on their representation of the landscape of the Melka watershed, where land degradation is the major problem. Development agents and village representatives of the selected villages selected the farmers based on land holding wealth category (land size: below average, average, above average) and gender. A total of 45 participants were selected from the three villages for the Participatory Rural Appraisal (PRA) and individual interviews. Accordingly, 15 farmers (9 men and 6 women) were selected from each village for the PRA survey. After the PRA discussion, 9 farmers (6 men and 3 women) representing the 3 wealth categories were selected from each village for individual interview to generate quantitative information.

c) Data analysis

The feed assessment tool (FEAST) excel macro program (www.ilri.org/feast) was used for data summary and analysis. Narrative responses collected during the group discussions were examined and reported in qualitative manner.

III. Results and Discussion

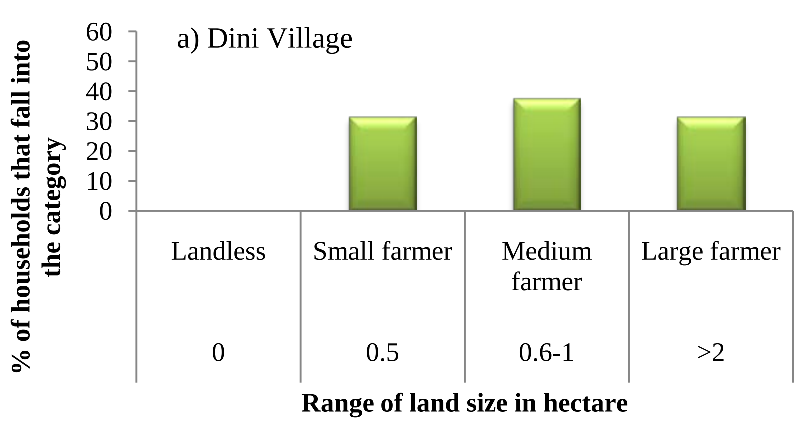
a) General observation of the study villages

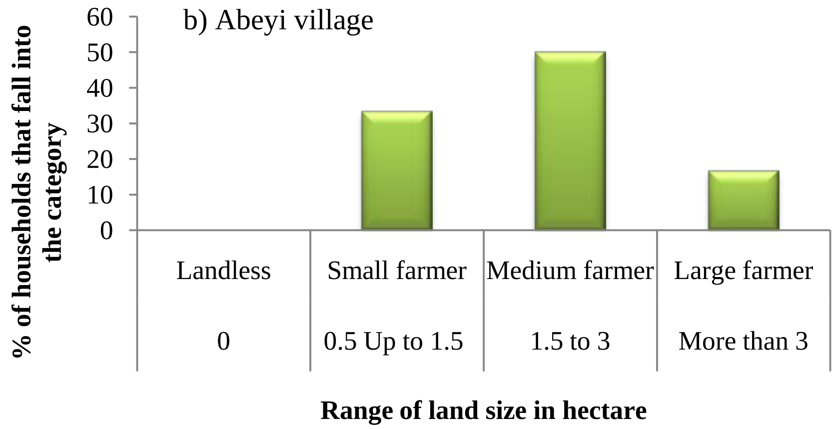
Mixed crop-livestock production is the dominant production system in all the three villages. The number of households in Dini, Abeyi and Bore'a villages were reported to be 64, 30 and 90, respectively, and the average family size per household was reported to be 7 persons for Dini, 6 persons for Abeyi and 5 persons for Bore'a villages.

b) Land holding

The average land holding per household for various wealth groups is indicated in Figure 1. According to the definition of land holding size category developed by the respondents from each village, most households in Dini and Bore'a villages have medium size of land holding whereas small land holding was reported to be most prevalent in Abeyi village. However, it is to be noted that the definition of small, medium and large land holding sizes are different in the three villages.

The land holding size of the households in Dini village varies from 0.5 to 5 ha. Accordingly, <0.5 ha, 0.5-2 ha and greater than 2 ha were considered as small, medium and large holdings, respectively (Figure 1a). About 37.5 % of the households in Dini village are categorized under medium land holdings whereas small and large land holdings amount to 31.25% each. Almost 50% of the farmers in Abeyi village own less than 1 ha of land. The percentage of farmers having large land holding is lower in Abeyi than in Dini village. In Bore'a village, the majority of the households own between 1.5 and 3 ha of land, which was categorized as medium size in the village. The proportion of farmers who own greater than 3 ha (large land holding) in the village is smaller than those who own small and medium land holdings (Figure 1c). There was no report of landless farmers in any of the three villages.





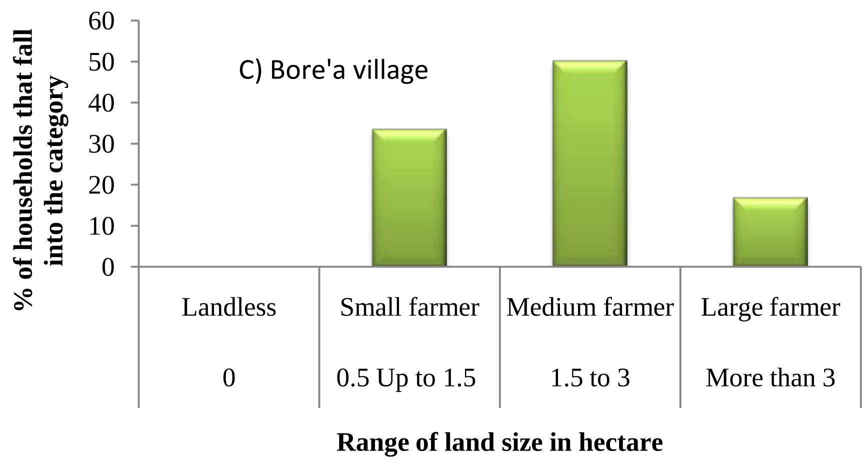


Figure 1 : Land holding size of the study villages

c) Crop production

The district is characterized as a mixed crop-livestock production system. Land preparation is mainly done by ox-drawn plough. The area has a bi-modal rainfall pattern with two distinct rainy and cropping seasons. The main rainy season (*meher*), which is also the main cropping season, extends from June to September. The short rainy season, known as "*belg* rain", usually covers the period from February to April. The respondents indicated that the small rainy season has become less dependable for cropping during recent years. As a result, most farmers depend on irrigation for their farming operations during this period. The villages are located near the Melka river, which serves as source of water for irrigation during the dry season. The type of irrigation practiced in the area is small scale traditional furrow irrigation that operates using natural gravity.

The main crops grown in the study areas include wheat (*Triticum aestivum*), tef (*Eragrostis tef*), broad bean (*Vicia faba*), barley (*Hordeum vulgare*) and potato (*Solanum tuberosum*) as shown in Figure 2. In addition, sorghum (*Sorghum bicolor*) is grown in Dini village whereas maize (*Zea mays*) is grown both in Abeyi and Bore'a villages. The crops grown by the farmers are used both for household consumption and as sources of cash income. Potato and maize are mostly grown for sale to generate cash income for the family whereas the other crops are grown largely to satisfy the food consumption needs of the families. Potato and maize are commonly grown in the dry season with the help of irrigation from Melka river. Most of the available crop land is allocated for production of wheat, which indicates that it is the most preferred crop in the area. This is followed by tef in Dini and Abeyi and by barley in Bore'a villages.

Crop residues are used as major sources of livestock feed during the dry season. However, small amounts of crop residues are sold as an income source and are also used for house construction, particularly for plastering of walls and thatching of roofs. Some farmers also use crop residues for mulching purposes to enhance fertility of the soil. Despite the importance of fodder crops as livestock feed, farmers in the area hardly grow improved forage crops. Moreover, the extension service to support forage development in the area appears to be weak and non-functional.

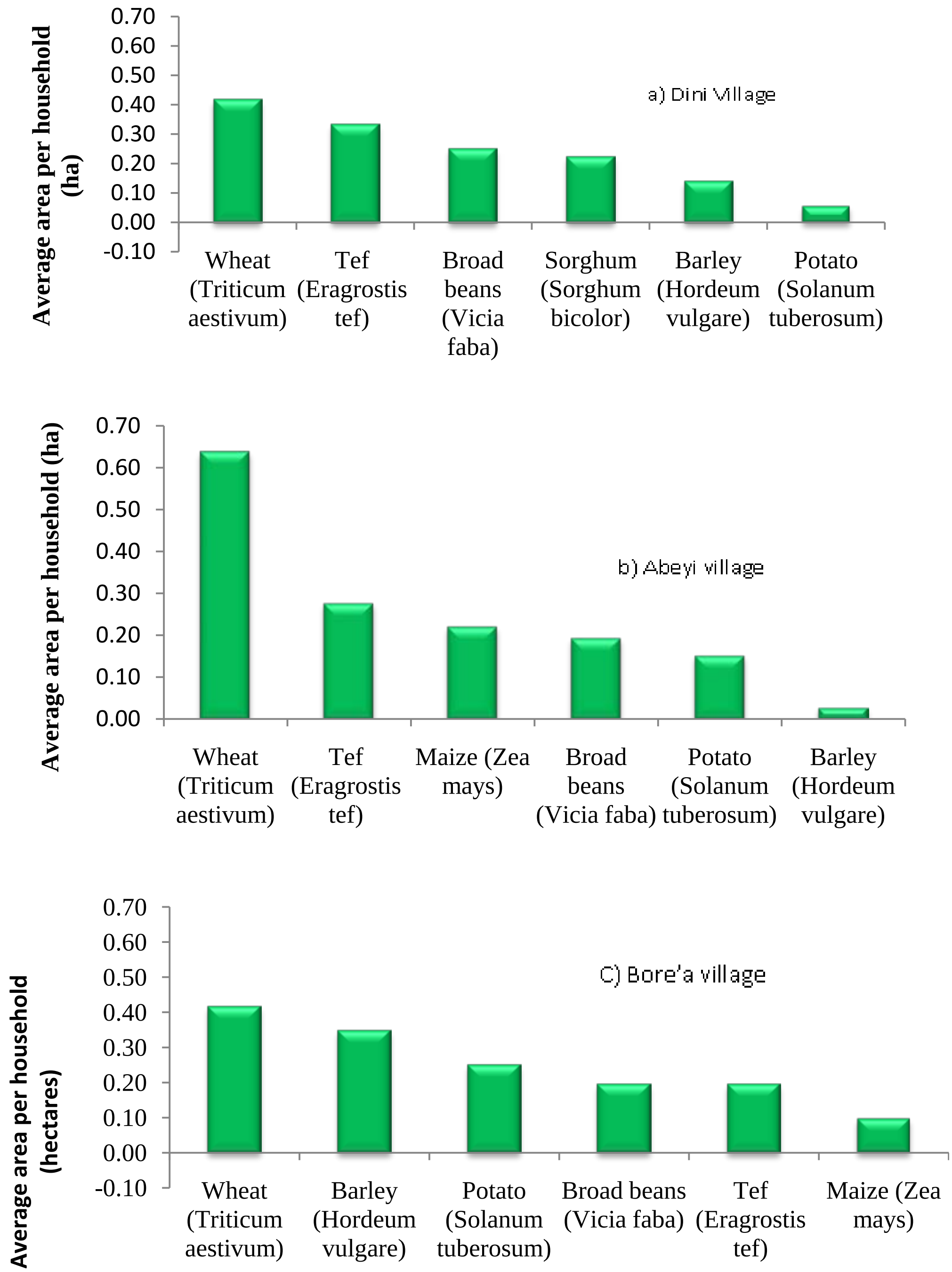


Figure 2 : Major crops grown in the study area

d) Livestock Production System

Livestock are an integral part of the farming system in the district as well as in the study villages. The main purpose of keeping livestock is for draught power. Livestock products such as milk and meat have secondary importance to the farmers. Small ruminants are mainly used as income sources as well as for household consumption.

The livestock production system commonly found in the villages is an extensive system where open grazing is the main style of feeding. The common breeds of cattle available in the area are mixed highland zebu types. Some crossbred or improved dairy cattle are also found in Bore'a village. However, the proportion of improved dairy cattle is very small compared to the local cattle. Local cattle, horses and sheep are the main livestock species kept by the households (Figure 3). In addition to horses, some farmers in Dini village keep donkeys that are vital for transport of goods from place to place. They are particularly important for transporting farm produce to the market and agricultural inputs to the farm. Limited numbers of scavenging village chickens are also raised by some farmers in all the three villages.

Local dairy cows are kept mainly for the purpose of milk production, breeding, manure, dung cake (cooking fuel), meat and as a source of income. The average milk production per cow is about half a liter per day. All milk produced by the household is consumed since the milk marketing culture is not common in the area. Oxen are mostly kept to fulfill draught power requirements whereas equines are a vital means of transporting goods and people. In addition to providing draught power, oxen are important for provision of manure, dung cake (cooking fuel), meat and to generate cash income.

Livestock housing is not common in the area. Except young calves and sheep, mature cattle and equines are kept in an open kraal at night all year round. However, about 30% of the farmers in Bore'a village house their cattle during the night. These are apparently those farmers who keep crossbred dairy cattle.

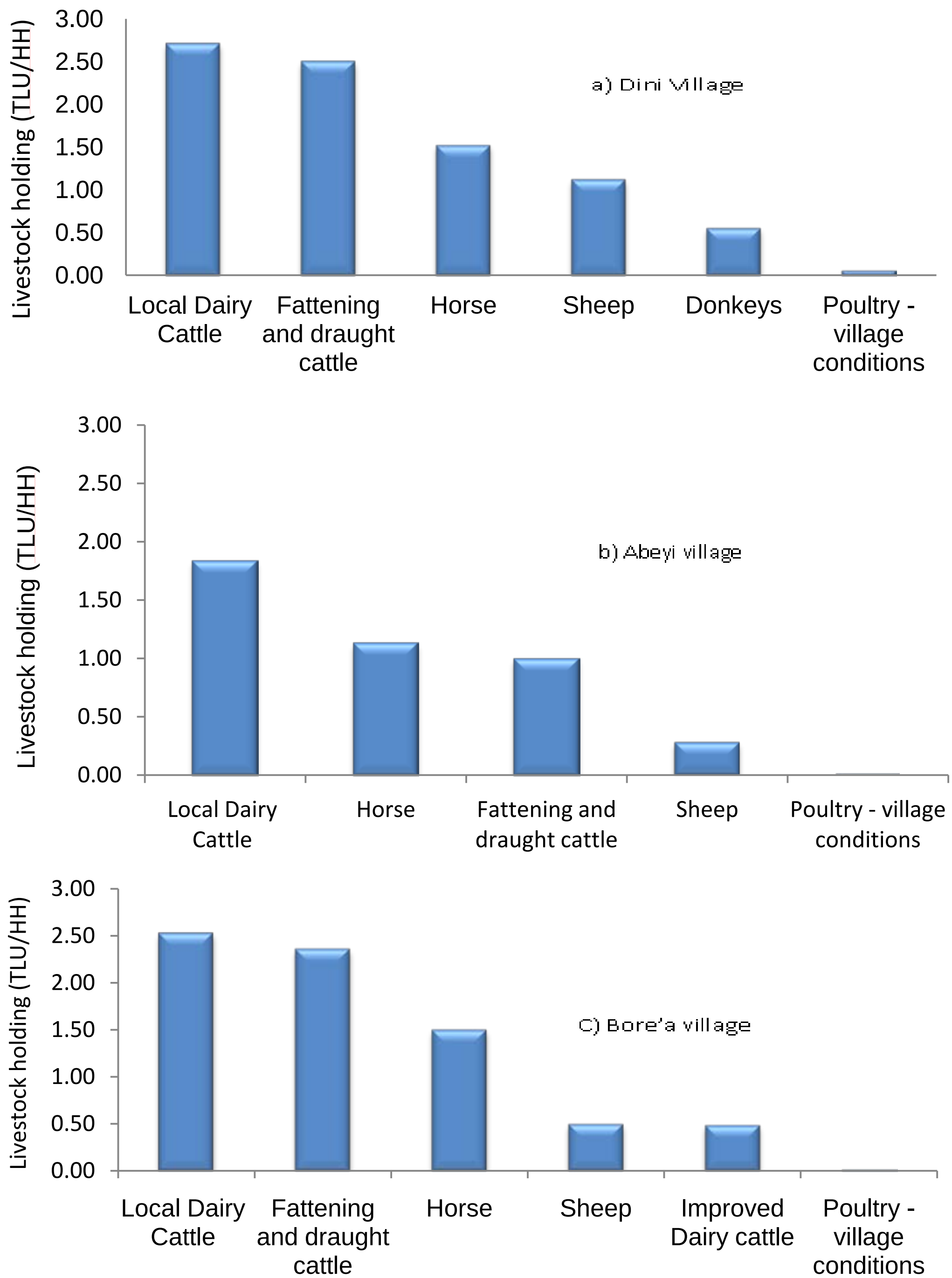


Figure 3 : Average livestock holdings per household in the three study villages (TLU)

Natural pasture and crop residues are the main sources of livestock feed in the area. The animals are allowed out for grazing during the day. Stall feeding or the cut and carry system are not yet practiced by the households. Feed processing such as chopping, urea treatment and mixing of different feeds is not practiced in Dini village whereas farmers from Abeyi and Bore'a villages reported that they chop maize stover before feeding to the animals. In addition, farmers in Bore'a village practice mixing of crop residues with local brewery by-products and common salt to improve palatability and intake of the feed and performance of the animals.

The respondents from Dini village indicated that veterinary services are easily accessible whereas the respondents from Abeyi and Bore'a villages reported that although the service is available it is not easily accessible because of its location in Gojo town of Jeldu district, which is far away from the villages. It was also learned that artificial insemination (AI) service is not easily accessible to any of the three villages as the villages are far away from the service provision center. The respondents from Dini village indicated that they can access bull service at the cost of Ethiopian birr 50 per service whereas farmers in Abeyi village depend on uncontrolled natural mating due to lack of access either to AI or bull service in the area. On the other hand, both AI and crossbred bull service were reported to be available in Bore'a village although the access could be limited due to various reasons. The service charge for the crossbred bull service in Bore'a was reported to be Ethiopian birr 100.

e) Labour Availability

Labour is an important resource in agricultural activities in determining the production and productivity of a given household. The respondents from all the three villages indicated that labour is available throughout the year but varies from season to season. Family labour is the main source of farm labour except for potato production for which farmers commonly use hired labour. Labour is highly demanded during planting and harvesting seasons. The average daily wage payment per individual is around 30 Ethiopian birr. In addition, the farmers provide meal and local drink to the workers, which could cost around 25 Ethiopian Birr/day for each worker. Due to shortage of agricultural land in the area, some farmers may also leave their village looking for employment in other places during the months of September to December.

f) Agricultural inputs

To increase production and productivity of crop and livestock, input utilization is important. Inputs such as improved seed, fertilizer, pesticides, insecticides, irrigation facilities, livestock feed and improved cattle breeds were mentioned by the respondents. It was indicated that agricultural inputs like irrigation equipment, improved crop varieties and improved animal breeds are not readily available. According to the respondents, irrigation equipment is not available in the local market. However, it was indicated that fertilizer is readily available in the local market although most farmers are unable to purchase the required quantity because of its high price.

g) Credit services

Credit sources for purchase of livestock and crop production are not satisfactory. Although credit facilities are available from microfinance institutions such as Oromia Saving and Credit Share Company and *Busa Gonofa* microfinance, most farmers do not use the services because of fear of risks associated with crop and livestock performance failures that could lead to failure of repayment of the loan. Moreover, the credit services provided by the micro-finance institutions are group based; which makes individual farmers accountable for the group members who are unable to pay their loan. It was also indicated that the service provision is limited to only once per year so that it may not be available when it is needed most.

h) Household income sources

The various income sources for households in the study villages are indicated in Figure 4. In Dini village, about 36% of the household income comes from sale of crops such as wheat, potatoes and onions. On the other hand livestock and livestock products contribute about 28% of the total income of the households. The third income source for the households in this village comes from different businesses such as petty trading and casual work.

In Abeyi village, about 46% of the household income comes from the sale of fattened animals (sheep and cattle) and followed by horticultural crops (35%), such as potatoes and onions. In Bore'a village, 42% of the interviewed households generate their income from sale of food crops whereas 26% benefit from sale of poultry, eggs, small ruminants and dairy products. Furthermore, horticultural crops such as potato and cabbage contribute about 8% of the income share.

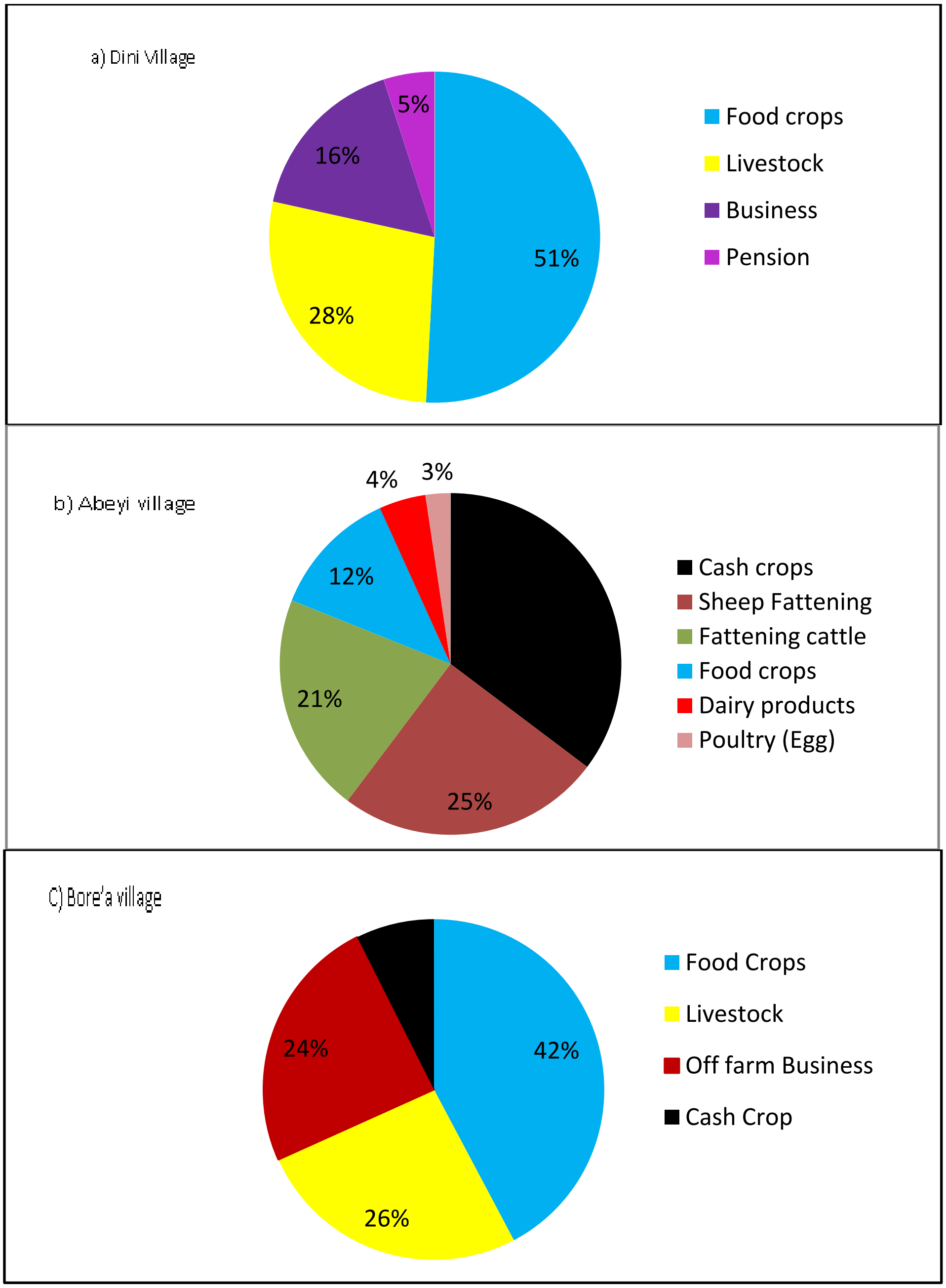


Figure 4 : Contribution of livelihoods activities to household income (as percentage)

i) Available feed resources

Livestock feed is one of the major inputs to improve livestock production and productivity. The major livestock feed resources include grazing, crop residues and naturally occurring and collected grasses. Availability of these feeds varies across different months of the year. During the rainy season, grazing pasture and naturally occurring and collected grasses are the two most important feed resources in the area. Availability of grazing pastures largely relies on rainfall and it is adequately available from the onset to the end of the main rainy season (June to October). However, crop residues are the main livestock feed sources in the dry season of the year. They are the main feed resources available to animals from January to May, a period of critical feed shortage (Figure 5). Surplus feed is obtained following the cessation of the heavy rainy season whereas moderate feed supply is available during the months of June, July, August and December. Despite the periodic availability of surplus pasture at the end of the main rainy season, fodder conservation to overcome the problem of feed deficit during lean period of the year is not a common practice in the area. Although, crop residues are the sole feed resource in

Global Journal of Science Frontier Research (D) Volume XV Issue IX Version I Year 2015

the dry season, all farmers provide straw to their animals without any physical or chemical treatment such as chopping and application of urea.

The production of improved and cultivated forage crops is not a common practice in the study area except the recent intervention made by the Nile Basin Development Challenge (NDBC) pilot project on plots of a few households. As part of the NBDC pilot project, Dasho grass (*Pennisetum pedicellatum*) and Napier grass (*Pennisetum purpureum*) as well as Lucerne and Bana grass (*Pennisetum purpureum x P. glaucum*) have been established in the backyard by some of the respondents (Figure 6). However, the farmers have not yet started using the grasses to feed to their animals.

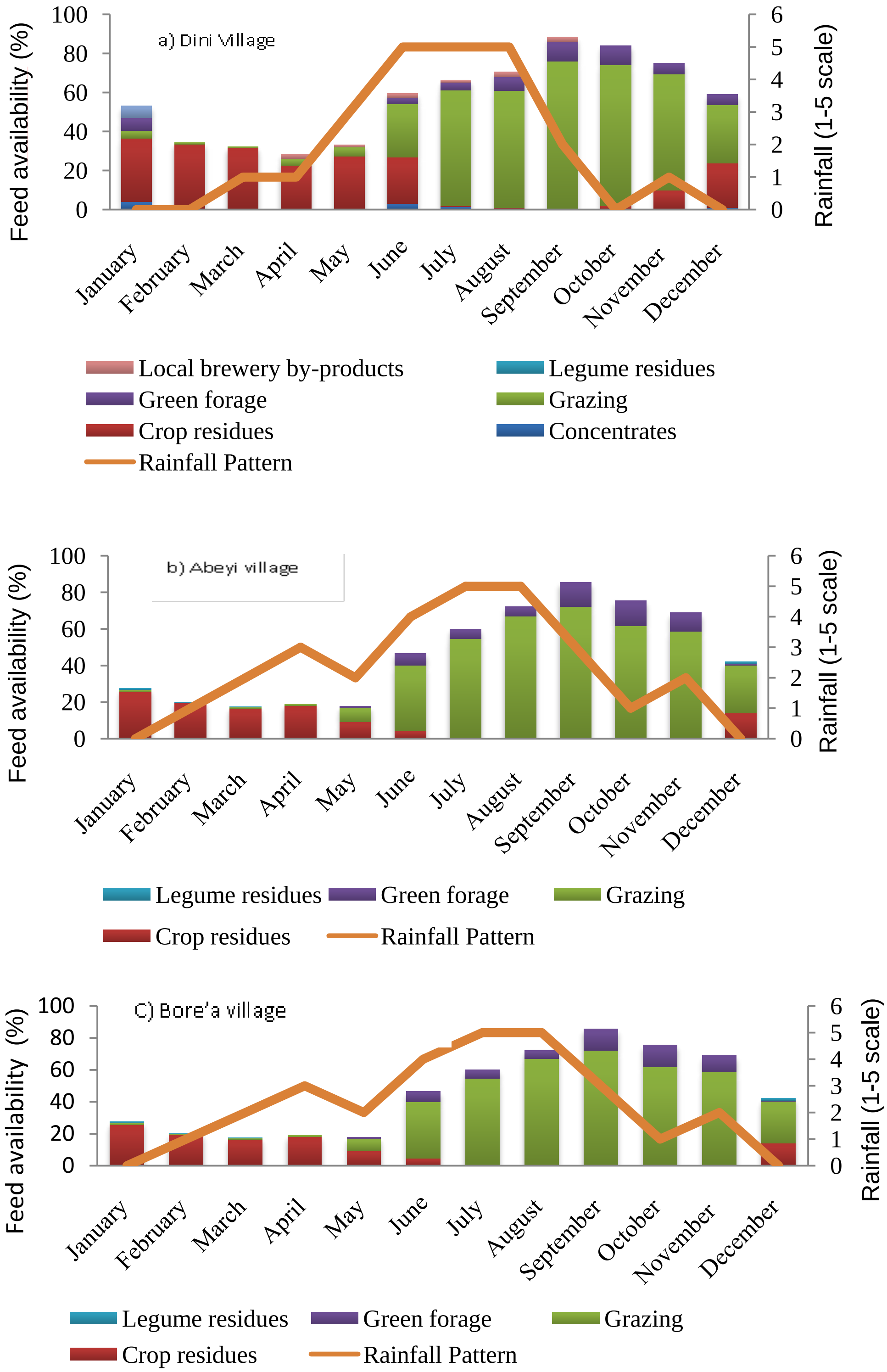


Figure 5 : The composition of the livestock feed throughout the year in relation to rainfall pattern

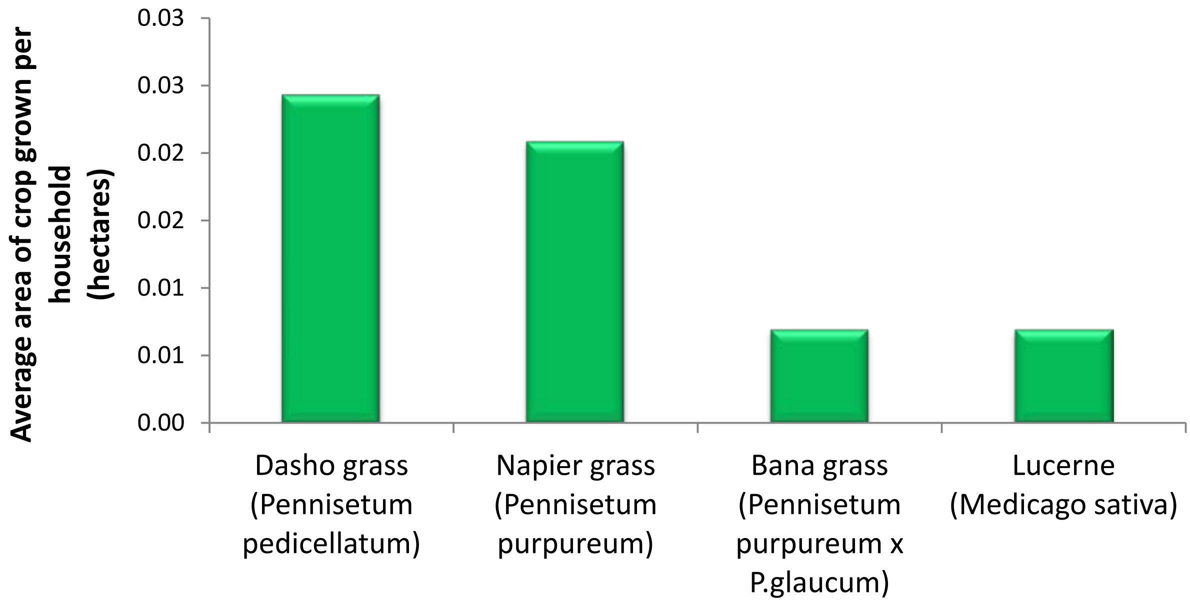


Figure 6 : Dominant fodder crops grown at Bore'a village

A few farmers purchase different feeds including crop residues. Wheat and tef straw are some of the purchased feed types by farmers. Some farmers who own more animals and who can afford it also purchase naturally growing pasture from nearby local farmers. Very few farmers also purchase noug seed cake, linseed cake and wheat bran from local vendors. Figure 6 shows that almost equal proportions of these agro-industrial by-products were purchased over a 12 month period in Bore'a village. In the dry season, concentrate feeds are mixed with crop residues and salt before providing to animals. Most of the farmers refrain from using concentrate feeds because of their rising price.

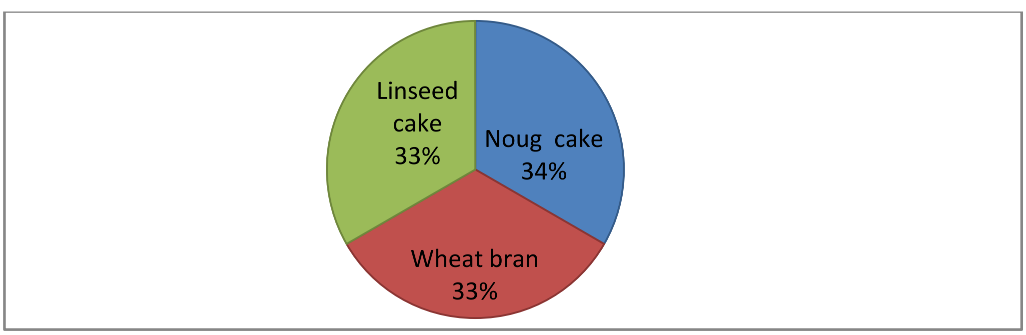


Figure 7 : Quantity of concentrate feeds purchased over a 12 month period at Bore'a village

The contribution of feed resources to the total dry matter (DM), metabolic energy (ME) and crude protein (CP) content of livestock diets in Dini, Abeyi and Bore'a villages is shown in Figures 8, 9 and 10, respectively. In Dini village, about 70% of the dry matter of livestock feed is obtained from grazing pasture while crop residues and naturally occurring and collected feeds accounted for the remainder (Figure 8, A). Large proportions of metabolizable energy and crude protein are also supplied by grazing pastures (Figure 8, B and C). In a similar way, in Abeyi, the largest share of livestock feed is obtained from grazing, which accounted for approximately 58% of the total dry matter, 60% of the metabolizable energy and 59% of the total crude protein of the diet, respectively (Figure 9: A, B and C). In a similar way, grazing and crop residues contribute to the largest proportion of DM, ME and CP content of the total diet in Bore'a village (Figure 10: A, B and C).

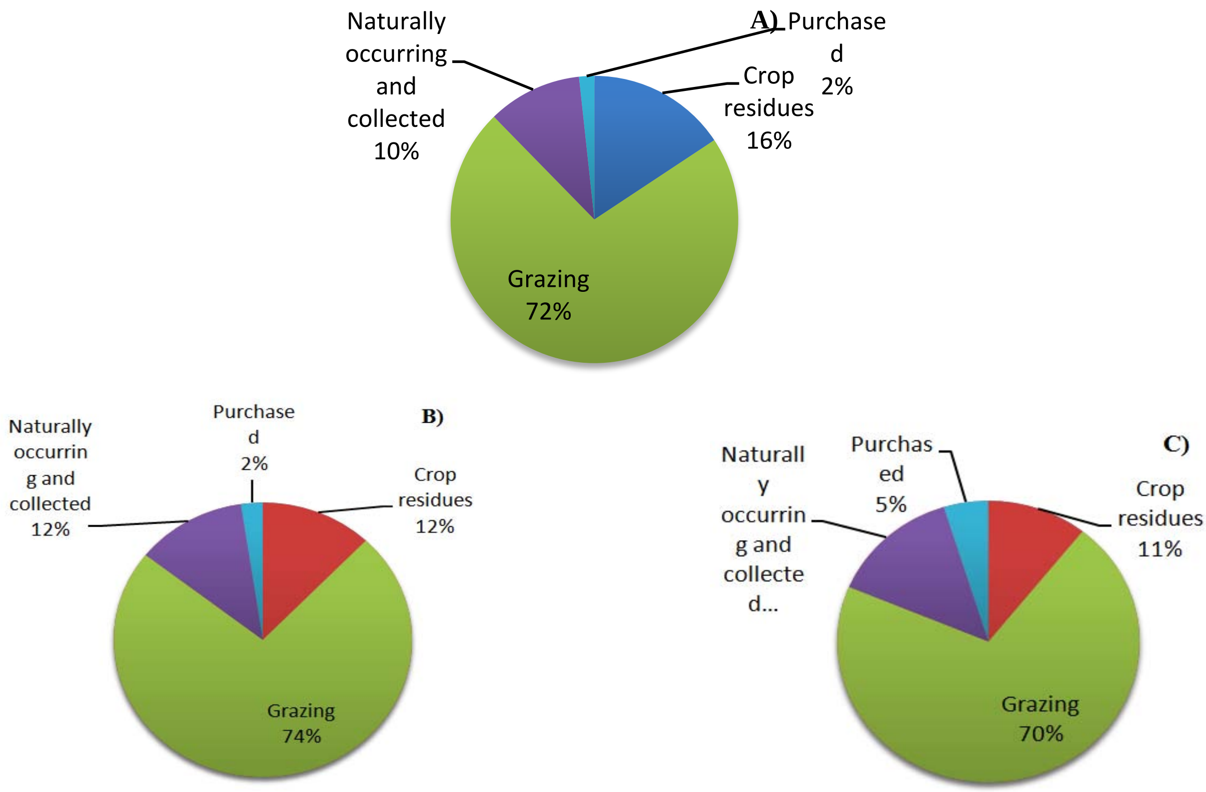
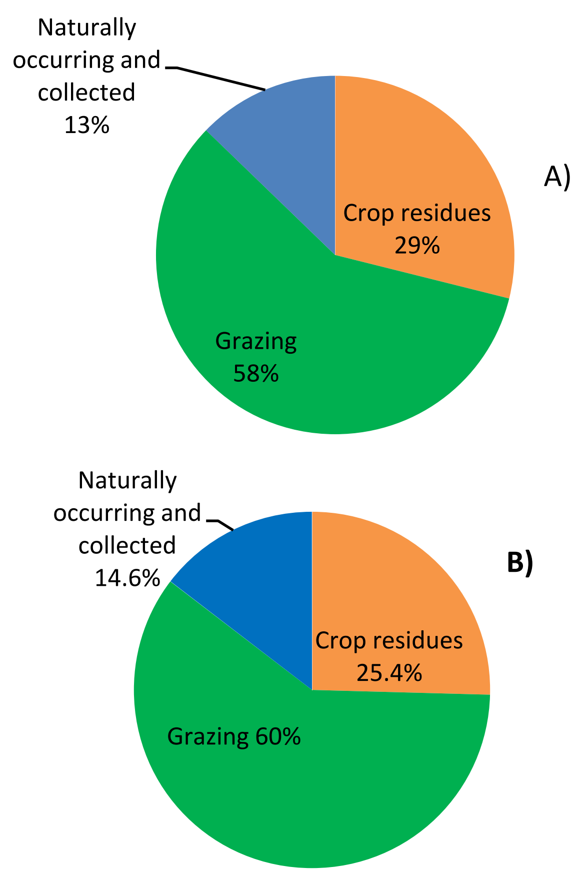


Figure 8 : Contribution of different feeds to the dry matter (A), metabolizable energy (B) and crude protein content (C) of the total diet of livestock at Dini village



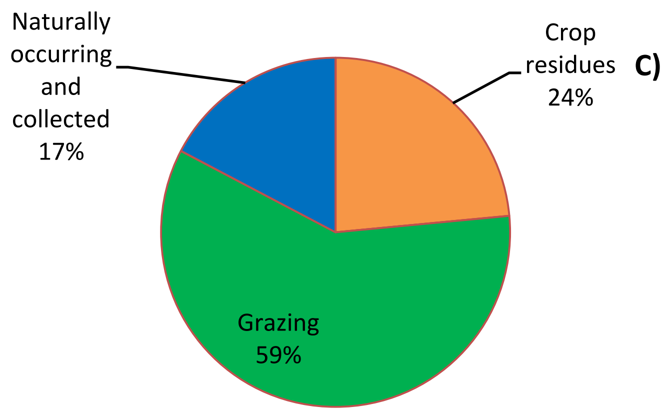
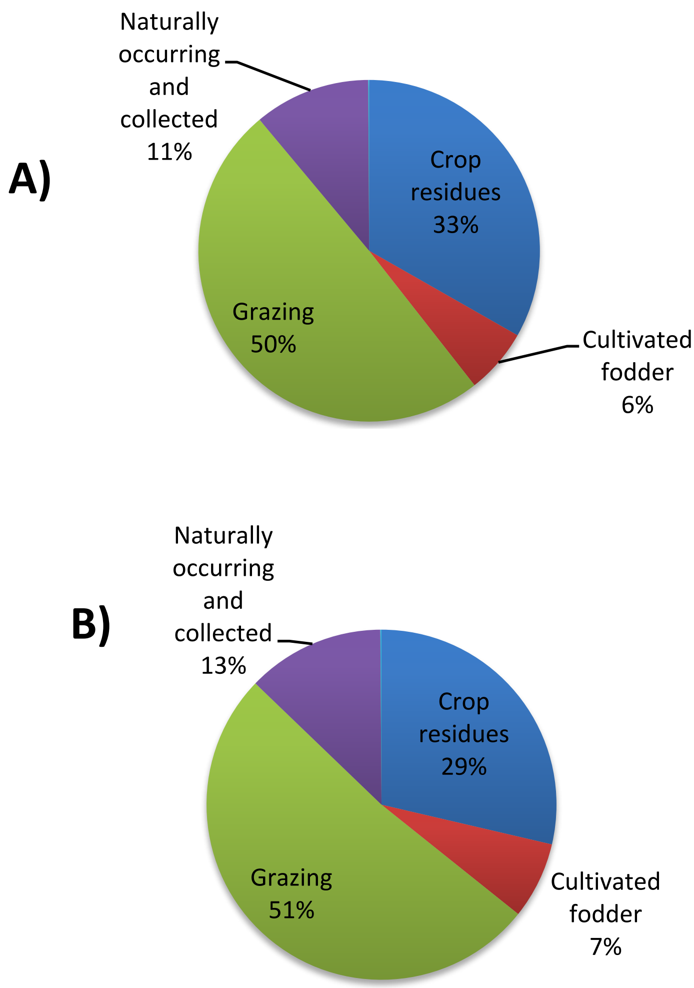


Figure 9 : Contribution different feeds to the dry matter (A), metabolizable energy (B) and crude protein content (C) of the total diet at Abeyi village



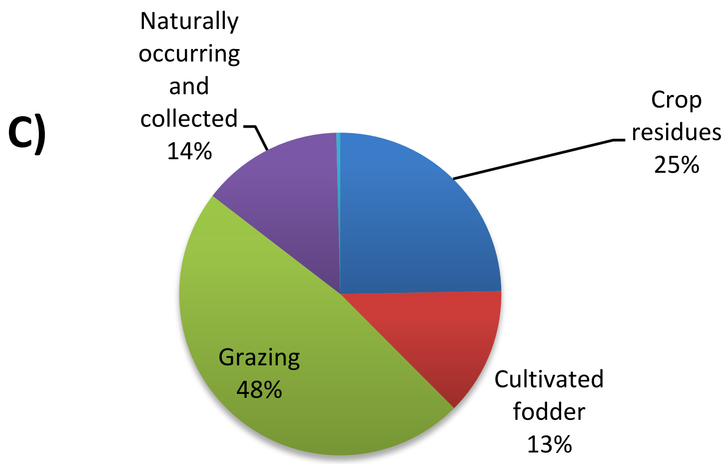


Figure 10 : Contribution different feeds to the dry matter (A), metabolizable energy (B) and crude protein content (C) of the total diet at Bore'a village

j) Main livestock production constraints

Based on pair wise ranking, a number of problems were ranked by the respondents in order of their importance. The farmers who took part in the PRA discussion also suggested some solutions to solve the problems in their respective villages. Shortage of livestock feed was identified as a major problem in all the three villages (Tables 1, 2 and 3). The other problems identified in Dini village were lack of improved cattle breeds, land shortage, land degradation and animal diseases (Table 1).

Limited knowledge/awareness, lack of animal health services and lack of improved animal breeds were other problems identified by the participants from Abeyi village (Table 2). The participants from Bore'a village identified lack of animal health services, poor genetic make of indigenous livestock breeds and lack of capital as additional constraints affecting livestock production in their village (Table 3).

Table 1 : Major livestock production problems identified and solutions suggested by PRA participants in Dini village

Problems	Problems listed	Suggested solutions
1	Livestock feed shortage	• Establish improved forages at backyards and multiply them • Reduce herd size • Training on how to establish and manage improved forages • Minimize free grazing
2	Lack of improved cattle breeds	• Artificial Insemination services provision • Improved bull services
3	Land shortage	• Reducing herd size • Intensification of cattle rearing • Production of improved fodder varieties
4	Land Degradation	• Vegetation of the area • Terracing • Proper plowing on steep slopes • Soil fertility management
5	Animal Diseases	• Establishment of animal health posts in nearby village • Assigning animal health workers

Table 2 : Major livestock production problems identified and solutions suggested by PRA participants in Abeyi village

Problems	Problems listed	Suggested solutions
1	Livestock feed shortage	• Establish improved forages in backyards. Reduce herd size and focus on productive ones • Minimize free grazing
2	Limited knowledge/awareness	• Proper extension service and training on livestock husbandry, management and production
3	Lack of animal health services	• Make animal health clinic and services available at *kebele* level • Training on intensive livestock management system
4	Poor genetic makeup of indigenous breeds/lack of genetically improved animals	• Provide AI service coverage • Provide improved bull service

Table 3 : Major livestock production problems identified and solutions suggested by PRA participants in Bore'a village

Problems	Problems listed	Solutions suggested by farmers
1	Livestock feed shortage	• Improve utilization of crop residue • Reduce herd size • Improve grazing land management • Plant suitable improved forage varieties
2	Lack of animal health services	• Provide animal health clinics and services at the *kebele* level • Training on intensive livestock management system
3	Poor genetic makeup of indigenous breeds/lack of genetically improved animals	• Promote AI services and improve availability • Offer improved bull services and create awareness
4	Lack of capital	• Improve existing credit service mechanisms.

IV. Conclusion and Suggestions for Future Interventions

Livestock production is an integral component of the agricultural production system in the three study villages. Livestock production in the study area is mainly based on production of indigenous livestock breeds, with the exception of Bore'a village, where some farmers keep crossbred dairy cattle. Livestock serve as sources of draught power and manure for crop production, and sources of meat, milk and eggs and as sources of cash income. However, the productivity level of the livestock resources was indicated to be very low. The respondents from the different villages identified different constraints that affect productivity of their animals, among which shortage of feed was ranked as the most important constraint in all the three villages. Natural pastures and crop residues are the main feed resources and their availability varies from season to season. The availability and use of improved forages and concentrate feeds is almost nil. Thus it would be necessary to alleviate the prevailing livestock production constraints in order to enhance the productivity and contribution of the livestock resources to the livelihood of the households in the study village as well as the district. To this effect, it is suggested that future interventions take the following issues into account.

- Provide farmers with training on appropriate utilization of available feed resources and development and use of improved forages. Strengthen and reinforce the fodder development practices already started in the village by providing follow up training and linking to strategic feeding practices. Link the fodder intervention to the existing soil and water conservation activity of the community
- Improve utilization of available feed resources through application of appropriate processing and supplementation methods
- Introduce appropriate fodder conservation methods when green feed is in excess during some months
- Strengthening the existing livestock extension system particularly management, husbandry, feeding, and animal health in the village
- Improve the indigenous animal genetic potential through selection and crossbreeding
- Provide access to improved dairy cattle for the farmers who wish to enhance productivity of their animals. This needs to be linked with improved forage production and availability of good quality feed resources.

V. Acknowledgements

The authors thank the International Livestock Research Institute particularly the Nile Basin Development Challenge (NBDC) pilot project for financial support to conduct the study. The authors would also thank farmers in the study area for their patience and willingness to conduct the interview.

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Assessment of Village Chicken Production Systems in Kambata Tambaro and Wolaita Zones, SNNPR, Ethiopia

By Aman Getiso, Fitsum Tessema, Mesfin Mekonnen, Addisu Jimma & Bereket Zeleke

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Abstract- The study was conducted in four woredas (Damot Gale,Of a, Angacha and Hadero Tunto) the first two of them found in Wolaita zone and two of them in Kambata Tambaro Zone of SNNPR, Ethiopia respectively. A cross-sectional survey was conducted in the study areas to assess village chicken production systems, productive and reproductive performance of village chicken and identifying constraints to village chicken production. Stratified random sampling technique was used to select 240 farming households and administer a pre-tested and structured questionnaire. The results showed that the mean age of interviewed farmers was 37.8±9.3 years; average family size & chicken owned per household were 6.8±2.4 persons and 8.6±1.7 heads, respectively. There was no significant differences ($p \geq 0.05$) found among the four woredas in all the above traits. The average number of clutch and eggs per hen per year of local chicken in the study areas were 4±0.87 and 12.9±3.47 respectively.

Keywords: indigenous chicken, production systems, SNNPR, Ethiopia.

GJSFR-D Classification : *FOR Code: 079999*

ASSESSMENTOFVILLAGECHICKENPRODUCTIONSYSTEMSINKAMBATATAMBAROANDWOLAITAZONESSNNPRETHIOPIA

Strictly as per the compliance and regulations of :

Assessment of Village Chicken Production Systems in Kambata Tambaro and Wolaita Zones, SNNPR, Ethiopia

Aman Getiso [α], Fitsum Tessema [σ], Mesfin Mekonnen [ρ], Addisu Jimma [Ѡ] & Bereket Zeleke [¥]

Abstract- The study was conducted in four woredas (Damot Gale,Of a, Angacha and Hadero Tunto) the first two of them found in Wolaita zone and two of them in Kambata Tambaro Zone of SNNPR, Ethiopia respectively. A cross-sectional survey was conducted in the study areas to assess village chicken production systems, productive and reproductive performance of village chicken and identifying constraints to village chicken production. Stratified random sampling technique was used to select 240 farming households and administer a pre-tested and structured questionnaire. The results showed that the mean age of interviewed farmers was 37.8±9.3 years; average family size & chicken owned per household were 6.8±2.4 persons and 8.6±1.7 heads, respectively. There was no significant differences (p≥0.05) found among the four woredas in all the above traits. The average number of clutch and eggs per hen per year of local chicken in the study areas were 4±0.87 and 12.9±3.47 respectively. The major feed resource in the study area was scavenging feed resource with supplementation of grains(wheat and Maize grain) even though the adequacy is under consideration. The results also indicated that most of the chickens share their residence with their owners (perches in the house) (79.1%) and only few of the respondents (14.1%) have separate houses for their chicken. Respondents prioritized limited skill of management practices and low productivity of the local chicken as major constraints to chicken production. Thus, technical and institutional interventions are very vital to lessen the prevailing constraints and transform the existing traditional/subsistence chicken production system to semi-commercial production system in the study area.

Keywords: indigenous chicken, production systems, SNNPR, Ethiopia.

I. Introduction

Animal production in general and chicken production in particular play important socioeconomic roles in developing countries (Alders 2004; Kondombo 2005) and the importance of village poultry production in the national economy of developing countries and its role in improving the nutritional status and incomes of many small farmers and landless communities has been recognized by various scholars and rural development agencies for the last few decades (Aberra and Tegene, 2011). Results by CSA (2013) indicate there are about 50.8 million chickens in Ethiopia of which 96.9 are local chickens, highlighting the significance of indigenous chickens as potential Farm Animal Genetic Resources of the country. Village based chicken production requires less space and investment and can therefore play an important role in improving the livelihood of the poor village family (Samson and Endalew, 2010).

Despite its importance, village chicken production system in Ethiopia is generally characterized by poor performance of local chicken in terms of egg production, small egg size, slow growth rate, late maturity, an instinctive inclination to broodiness and high mortality of chicks (Aberra, 2000; Nigussie et al., 2003; Solomon, 2003). On the other hand, local chickens are known for their ability to resist disease, thermo-tolerance, good egg and meat flavor, hard eggshells, high fertility and hatchability (Aberra, 2000).

Changing production systems and unsystematic cross-breeding are the major treats to native breeds (Hunduma et al., 2010; Besbes,2009). Recently, efforts are being made to increase the productivity of indigenous chickens of Ethiopia through selective breeding (Nigussie et al., 2010). Success of such breeding programs on village chicken requires defining the production environment and identifying breeding practices, production objectives and trait of choice of rural farmers. Moreover, to design appropriate development intervention programs on village chicken production, characterization of the production system and understanding the socio-economic implications are crucial (Pedersen, 2002).

Due to poor agricultural extension service, however, there is no documented information pertaining to the resource base, productivity and management of the chickens and the constraints in the study area. The objective of the study was to assess production system, productive and reproductive performance of village chickens and to identify production constraints in the study Woredas.

II. Materials and Methods

a) *Sampling and data collection*

The study was conducted in four woredas Wolaita zone (Damot Gale, Ofa) and Kambata Tambaro

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(Angacha and Hadero Tunto) of SNNPR, Ethiopia. From each woreda and a total of eight kebeles were used for the survey. From each of the selected kebeles, 30 households were randomly selected. Accordingly, a total of 240 (30hhs x 2 kebeles x 4woredas) households were used in the survey.

Data were collected using multiple subject formal survey using a pre-tested, structured questionnaire. Data collected include: household characteristics (family size, farmland holding and chicken flock size per household); various productivity of chicken and flock performance (number of clutches per year, clutch length, eggs/hen per year and inter clutch); Chicken management practices including (housing, feeding (feed availability, types and frequency of feeding), culling practices) and diseases and health care practices (major types, occurrences, symptoms and severity of diseases, and coping mechanism). Qualitative and quantitative data sets were analyzed statistically using Statistical Package for Social Sciences (SPSS) software, version 20.

III. Result and Discussion

a) Production system parameters of indigenous chicken in the study woredas

i. *Socio-economic characteristics of the households in the study woredas*

The overall average family size in the study woredas assessed was to be 6.8±2.4 head per household and was not significantly different ($p \geq 0.05$) in all study Woredas(Table 1). The results of this study referring to the average family size are similar to the findings of Deneke (2013), Zemene (2011) and Fisseha *et al.* (2010), in Tiyo, Hetossa and Dodota woredas of Arsi zone of Oromia, Goncha Siso Enese woreda of Western Amhara region and in Bure woreda of North West Amhara of Ethiopia, respectively.

Results showed that from the total of 240 households' interviewed 70.8% were males and 29.2% were females. The average age of the respondents in the study woredas was 37.8±9.3years. Assessment of educational profile of the household heads indicated that the majority were grade 5–8, followed by high school (9-12) education, illiterate and those who attended formal elementary level (grade 1- 4) education.

The average chicken population in the study Woredas was 8.6±1.7 (Table1). This result was significantly lower than the study observed by Deneke (2013) and Solomen et.al. (2013) in Tiyo, Hetossa and Dodota woredas of Arsi zone of Oromia and in Metekel zone, Northwest Ethiopia respectively. But this result is in agreement with the findings by Mulugeta and Tebkew (2013) in Awi -administrative zone, Amhara Region, Ethiopia.

Table 1 : Socio-economic characteristics of households in the study woredas (Mean±SD and Frequency and Chi-square values)

Parameter (%)	Study woredas				Over all (N= 235hh)	χ^2
	Damot Gale (N=59hh)	Ofa (N= 60hh)	Angacha (N=56hh)	Hadero and Tunto (N=60hh)		
Age of respondents (year)	38.2±7.9	40.0±10.4	37.4±8.4	35.6±9.8	37.8±9.3	
Family size of respondents (persons)	7.1±2.5	6.2±2.4	6.7±2.6	7.2±2.2	6.8±2.4	
Livestock ownership Last year (head)						
Cattle	3.6±1.8	5.0±3.5	2.7±1.6	2.6±1.9	3.5±2.5	
Small ruminants	2.5±0.9	7.0±5.0	6.1±5.0	5.0±4.2	5.1±4.4	
No. Chickens	8.5±1.7	8.5±1.6	8.9±1.4	8.5±2.0	8.6±1.7	
No. Equines	6.0±0.0	6.0±0.0	6.0±0.0	5.5±1.4	5.9±0.7	
Sex of respondents						χ^2
Male	91.7	75.0	66.1	50.0	70.8	26.291
Female	8.3	25.0	33.9	50.0	29.2	
Educational profile of respondents						
Illiterate	25.0	30.0	8.9	30.0	23.7	19.667
Elementary (1-4)	8.3	13.3	8.9	11.7	10.6	
Elementary (5-8)	38.3	31.7	33.9	36.7	35.2	
High school 9-12)	23.3	21.7	46.4	20.0	27.5	
Religion of respondents						
Protestant	90.0	98.3	94.6	96.6	94.9	12.336
Orthodox	3.3	1.7	3.6	1.7	2.6	
Catholic	6.7	0.0	1.8	0.0	2.1	
Muslim	0.0	0.0	0.0	1.7	0.4	

*hh = interviewed households; χ^2 = chi square; ** = significant $p \leq 0.01$*

b) *Chicken husbandry practices*

i. *Feeds and feeding*

Lack of feed supplementation is one of the char acteristics of a free-ranging backyard poultry production system (Gueye, 2003). Scavenging was the major feeding system in the study area. However, the farmers were found to supplement their chickens rarely with household refuse and grains (mainly maize, wheat, house hold scrubs and sorghum) (Table 2). Majority of the respondents provide supplementary feeds to the chicken on the bare ground followed by put in the feeder (Table 2). The results also indicated that most of respondents provide supplementary feeds by spreading the feeds simply on the ground for all chicken groups which leads to significant wastage of the feed while only a few respondents used feeder to provide supplementary. The present findings are in close accordance with the observations of Halima *et al*. (2007a) and Deneke (2013).

Even though all of the chicken owners provide supplementary feed to their chicken, it is not possible to say that it is adequate both in quantity and quality because they provide the feedstuffs without measuring. The observations are in agreement with the findings of Fisseha, (2008) and Deneke (2013). Spreading the feed on the ground for collective feeding, as was observed in the present study is in accordance with the observations of Zemene (2011) and Fisseha (2008).

Water is provided once, twice and thrice per day and *ad-libitum* to the birds all year round with particular emphasis during the dry season. The results of the study also indicated that majority of the respondents use plastic dish (mainly plastic pan locally called "*mastatebya*") (72.6%) while, some also use watering equipments made of clay (12.6%), wood trough (6.7%) and only 2.2% uses Nickel or iron dish.

Table 2 : Feed resources, feeding and watering of chicken in the study woredas

Parameter (%)	Study woredas					
	Damot Gale (N=59)	Ofa (N=60)	Angacha (N=56hh)	Hadero and Tunto (N=60hh)	Overall (N= 235hh)	χ^2
Types of supplementary feeds (%)						
Wheat grain	83.3	70.5	100	100	89.0	29.836
Maize grain	94.5	98.0	94.1	100.0	96.5	3.526
Barley grain	10.3	4.3	26.9	100	15.6	16.448
Sorghum grain	10.5	38.7	43.2	100.0	36.8	30.314
Oat grain	2.6	0.0	0.0	na	1.2	1.225
Cereal debris	69.6	68.9	77.5	100.0	78.5	15.885
Household scrubs	71.7	82.2	77.5	100.0	83.1	14.736
Bran	67.3	30.8	89.8	100.0	75.9	48.184
Cake	2.9	4.3	0.0	na	2.5	0.976
Bone meal	0.0	0.0	14.8	na	4.8	8.867
Meat meal	0.0	0.0	11.1	na	3.6	6.568
Salt	0.0	0.0	7.7	na	2.4	4.93
Sand/Bole	0.0	0.0	12.0	na	3.7	7.100
Method of feed provision (%)						χ^2
Put in feeder	52.8	16.7	50.9	46.2	42.2	43.882
On the bare ground	47.2	77.1	30.2	51.9	51.0	
Some times in feeder and on the bare ground	0.0	6.2	18.9	0.0	6.3	
Type of drinkers used (%)						χ^2
Plastic dish	71.2	66.7	78.2	74.6	72.6	32.990
Wooden Trough	9.6	1.8	0.0	15.3	6.7	
Clay made dish	17.3	14.0	10.9	8.5	12.6	
Nickel/iron dish	0.0	7.0	0.0	1.7	2.2	
Plastic and clay made dish	1.9	10.5	10.9	0.0	5.8	
Frequency of offering water per day(%)						χ^2
Once	19.2	43.9	30.9	22.0	29.1	25.75*
Twice	28.8	15.8	25.5	18.6	22.0	
Three times	25.0	8.8	16.4	30.5	20.2	
Every other day	5.8	7.0	0.0	0.0	3.1	
Adlib	21.2	24.6	27.3	28.8	25.6	

*hh = interviewed households; χ^2 = chi square; ** = significant p≤ 0.01 na= not available*

ii. *Housing and accommodation of chicken*

Housing is essential to chickens as it protects them against predators, theft, rough weather (rain, sun, cold wind, dropping night temperatures) and to provide shelter for egg laying and broody hen. Lack of construction materials (25.7%), lack of knowledge and awareness (35.1%), risk of predators (11.0%) and risk of theft (1.6%) were some of the major reasons mentioned by chicken owner farmers for not preparing a separate house for village chicken. And only 14% of the respondents constructed separate houses for their birds; the other 79.1% dwelling with their owners (perches in the house), 6% perches in the kitchen and 1.7% in the live stock house. Similar observations have also been reported by Deneke (2013), Mekonnen (2007) and Zemene (2011) from Arsi (Oromia), SNNPR and western Amhara areas of Ethiopia, respectively. From the result it could be understood that the housing management in the study area is not suitable for the well being of chicken and their products management, and thus it needs improvement. In support of this result, Melese and Melkamu (2003) reported that in some African countries, a large proportion of village poultry mortality accounted due to nocturnal predators because of lack of proper housing. This studies also indicated that majority of respondents encountered lack of knowledge (awareness) to separate poultry house (Table 3).

Table 3 : Night enclosure used and limitation to have separate houses in the study woredas

Parameter (%)	Study Woredas				Over all (N= 235hh	χ^2
	Damot Gale (N=59)	Ofa (N=60)	Angacha (N=56hh)	Hadero and Tunto (N=60hh)		
Night enclosure for chicken						
Separate shelter	5.1	0.0	30.4	21.7	14.0	62.166**
perches in the house	93.2	98.3	50.0	73.3	79.1	
perches in the kitchen	0.0	0.0	19.6	5.0	6.0	
Perches in livestock house	1.7	1.7	1.7	1.7	1.7	
Limitations to have a separate house						
lack of knowledge (awareness)	26.5	39.0	15.8	55.6	35.1	85.506**
lack of importance of poultry	0.0	0.0	2.6	0.0	0.5	
lack of construction materials	34.7	3.4	50.0	24.4	25.7	
Risk of predators	16.3	10.2	15.8	2.2	11.0	
Risk of theft	4.1	0.0	0.0	2.2	1.6	
Lack of construction material and risk of theft	0.0	1.7	7.9	2.2	2.6	
Lack of construction materials, risk of predator and risk of theft	6.1	1.7	2.6	0.0	2.6	
Risk of predator and risk of theft	10.2	28.8	2.6	2.2	12.6	
Lack of knowledge, lack of importance of poultry and lack of construction material	0.0	1.7	0.0	0.0	0.5	
lack of knowledge awareness and risk of predator	0.0	3.4	0.0	0.0	1.0	
Lack of knowledge (awareness) and lack of construction material	2.0	10.2	2.6	11.1	6.8	

*hh = interviewed households; χ^2 = chi square; **p≤ 0.01*

iii. *Productivity of indigenous chicken in the study woredas*

The result of the study (Table 4) indicates that the average number of egg clutch and number of clutch per year of indigenous chicken was 12.92±3.47eggs and 4.05±0.87 respectively. This result was significantly lower than the result reported by Deneke (2013) in Arsi, Oromia. But, this result was in accordance with the result reported by Solomon et.al. (2013) in Metekel zone, Northwest Ethiopia. Moges et al. (2010) also reported similar values, 15.7, 13.2 and 14.9eggs/hen/clutch and total egg production/hen/year of 60, 53 and 55, in Bure, Fogera and Dale districts of Ethiopia, respectively.

The results presented in Table 4 also indicate that the majority of respondents (63.6%) commonly used clay as incubating materials while wood container (10.9%) and mud container (2.2%). Overall, 98.7% of respondents in the study woreds provide "*teff*" straw as bedding materials for incubation. The present finding is agree with the reports of Deneke (2013). In other parts of Ethiopia, clay pots, bamboo baskets, cartons or even simply a shallow depression on the ground were common materials and locations used for egg setting (Fisseha, 2008).

Table 4 : Productivity of indigenous chicken in the study woredas (Mean ±SD, frequency and Chi-square values)

Parameters	Study Woradas				Overall	χ^2
	Damot Gale (N=58hh)	Ofa (N=60hh)	Angacha (N=55hh)	Hadero & Tunto (N=58hh)	(N=231hh)	
Average number of eggs per clutch (No.)	13.23±3.71	11.64±2.83	13.61±4.12	13.29±2.85	12.92±3.47	
Average number of clutches per hen per year (circle)	3.9±0.95	3.78±0.74	4.10±1.05	4.41±0.56	4.05±0.87	
Number of eggs /hen/month	12.9±3.3	11.4±2.5	12.5±2.2	13.3±9.1	12.5±5.3	
Frequency of incubation per hen per year (%)						
Once	0.0	6.8	1.8	0.0	2.3	38.323**
Twice	42.9	52.5	74.5	34.5	51.1	
Thrice	20.4	16.9	7.3	25.9	17.6	
Four times	36.7	22.0	14.5	34.5	26.7	
Five times	0.0	0.0	1.8	5.2	1.8	
Six times	0.0	1.7	0.0	0.0	0.5	
Materials in which the hens incubate (%)						
Mud container	2.0	0.0	5.5	1.8	2.3	59.898**
Clay	65.3	61.0	72.7	56.1	63.6	
Wooden container	12.2	8.5	3.6	19.3	10.9	
Mud and clay container	4.1	3.4	1.8	19.3	7.3	
Basket	4.1	22.0	5.5	1.8	8.6	
Mud, clay, wood container	2.0	1.7	0.0	1.8	1.4	
Plastic container	6.1	0.0	3.6	0.0	2.3	
Carton	4.1	1.7	7.3	0.0	3.2	
No container	0.0	1.7	0.0	0.0	0.5	
Bedding materials used during incubation						
Teff straw	100	96.7	100.0	98.3	98.7	4.812
Teff straw and old clothes	0.0	1.7	0.0	1.7	0.9	
Hay	0.0	1.7	0.0	0.0	0.4	

*hh = interviewed households; χ^2 = chi square; **p≤ 0.01*

iv. *Indigenous Chicken culling practices in the study areas*

The result of the study (Table 4) also indicated that majority (65.2%) of the respondents experienced in culling of unwanted or less productive chickens from their flock. According to the respondent farmers, the basic reasons for culling of chicken include less productivity (8.8%), old age (5.4%) and old age and low production (59.5%) with an average culling age of 4.3 years and old age, low production and illness (25.7%). Most of the farmers (82.2%) sold the culled chicken for income generation purpose. In support of this study, Melese and Melkamu (2014) and Halima (2007) reported that about 74.7% of the reasons for culling of chicken in North West Ethiopia are poor productivity, old age and sickness as a whole.

Table 5 : Indigenous chicken culling practices in the study woredas

Parameters	Study Woredas				Overall	χ^2
	Damot Gal (N=58hh)	Ofa (N=60hh)	Angacha (N=55hh)	Hadero & Tunto (N=58hh)	(N=231hh)	
Do respondents purposely cull their chicken at any time? (%)						
Yes	67.3	61.0	67.9	65.0	65.2	0.732
No	32.7	39.0	32.1	35.0%	34.8	
Major purpose of culling chicken (%)						
For consumption	2.9	0.0	2.6	5.6	2.7	17.162**
For sale (income)	94.3	91.7	74.4	69.4	82.2	
For consumption and for sale	2.9	5.6	23.1	25.0	14.4	
Major determinant factor for culling chicken (%)						
Old age	2.9	5.6	12.8	0.0	5.4	98.855**
Low production	8.8	13.9	5.1	7.7	8.8	
Bad temperament	0.0	0.0	2.6	0.0	0.7	
Old age and low production	85.3	72.2	74.4	10.3	59.5	
Old age, low production and illness	2.9	8.3	5.1	82.1	25.7	
Average culling age (mean ±Std)	4.3±1.5	4.5±1.2	4.5±0.9	3.6±1.0	4.3±1.2	

*hh = interviewed households; χ^2 = chi square **p≤ 0.01*

v. *Diseases and health management of chicken in the study woredas*

The results referring to disease outbreak among the chickens in the studied woredas are presented in Table 5. Results indicates that majority of the respondents (84.4%) in the study areas experienced disease outbreaks. This indicates that disease is one of the most important constraints impairing the existing chicken production system under farmer's management condition in the study area even though there were other constraints like lack of veterinary health service, traditional management system with limited feed supplementation, poor housing and no access of improved breeds with limitation of extension service. The major common disease observed in the study areas were respiratory disease (55.7%) followed by Newcastle disease (86.7%), Coccidiosis (39.2%) and Fowl cholera (20.2%).

This result is in line with the reports of Fisseha et al. (2007) who indicated that the major problem impairing the existing production system in Ethiopia is the high incidence of Newcastle disease. Aberra and Tegegne (2007) also indicated that Newcastle disease and fowl cholera are the major problems limiting chicken production in Ethiopia.

The results also indicate that the farmers use both traditional (ethno veterinary) and modern methods to treat the sick chicken. They use of traditional method includes using Casava leaf, Katicala smashed together, Bursa and Bisana leaf, Lemon, Timbaho, Bole, Tetracycline, Butter, Zinger, Pepper, Garlic, Tsid leaf, Misel and Mimi as a treatment. The use of ethno veterinary medicine as is being practiced is just by trial and error with no proper dosage and schedule.

Table 6 : Diseases and health management of chicken in the study woredas

Parameters	Study Woredas				Overall	χ^2
	Damot Gale (N=60)	Ofa (N=59)	Angacha (N=56)	Hadero & Tunto (N=60)	(N=235)	
Experience of chicken disease outbreaks (%)						9.167*
Yes	88.9	89.5	88.0	71.9	84.4	
No	11.1	10.5	12.0	28.1	15.6	
Poultry vaccination Campaign in the past 12 months						17.27**
Yes	17.0	0.0	20.4	27.6	16.2	
No	83.0	100.0	79.6	72.4	83.8	
Actions taken when chicken get sick						85.98**
Treat them myself	36.4	75.0	67.5	81.4	65.4	
Call in veterinarian	4.5	5.8	2.5	11.6	6.1	
Cull/kill them all immediately	25.0	0.0	0.0	0.0	6.1	
Sell them all immediately	0.0	1.9	2.5	0.0	1.1	
Treat them myself and call in veterinarian	22.7	7.7	7.5	4.7	10.6	
Treat them myself and take to veterinary clinic	11.4	0.0	12.5	0.0	5.6	
Treat them myself and sell healthy birds	0.0	3.8	0.0	0.0	1.1	
Keep them until cured or die	0.0	3.8	0.0	0.0	1.1	
No treatment	0.0	1.9	0.0	0.0	0.6	
Take to veterinarian	0.0	0.0	7.5	2.3	2.2	
Common chicken disease encountered in the study areas (%)						
Respiratory disease						
Yes	80.4	84.3	92.9	100.0	55.7	5.54
No	19.6	15.7	7.1	0.0	13.3	
Newcastle disease						31.82**
Yes	30.8	58.0	60.6	100.0	86.7	
No	69.2	42.0	39.4	0.0	44.3	
Coccidiosis						7.02*
Yes	24.4	42.3	55.6	na	39.2	
No	75.6	57.7	44.4	na	60.8	
Fowl cholera						8.52*
Yes	17.9	21.2	14.3	100.0	20.2	
No	82.1	78.8	85.7	0.0	79.8	
Local treatment used by farmers						157.6**
Casava leaf and caticala smashed together	15.4	0.0	0.0	0.0	1.9	
Casava, bursa and Bisana (Chroton megala) leaf	69.2	2.5	5.1	0.0	11.5	
Casava, timbaho leaf and mitmita smashed together	7.7	7.5	0.0	0.0	3.8	
Lemon, Bole, tetracyclin and butter	0.0	50.0	28.2	16.7	31.7	
Zinger, paper, sensel, gas, butter and garlic	0.0	0.0	23.1	8.3	9.6	
Lemon, casava, TTC and garlic	7.7	17.5	2.6	0.0	8.7	
Tsid leaf	0.0	5.0	0.0	0.0	1.9	
Grawa, mitmita and sensel smashed and mixed with water	0.0	0.0	17.9	0.0	6.7	
Peper with water	0.0	0.0	5.1	0.0	1.9	
Misel + butter	0.0	0.0	2.6	0.0	1.0	
Hebicho + tetra	0.0	0.0	0.0	8.3	1.0	
Tetra + garlic + lemon	0.0	0.0	2.6	25.0	3.8	
No treatment is given	0.0	10.0	7.7	16.7	8.7	
Tetra and lemon with butter	0.0	2.5	0.0	25.0	3.8	
Mimi + lemon + tetrea	0.0	5.0	0.0	0.0	1.9	
Timbaho with water	0.0	.0	5.1	0.0	1.9	

Poultry vaccination campaign held in the study areas					17.27**
Yes	17.0	0.0	20.4	27.6	16.2
No	83.0	100.0	79.6	72.4	83.8

*hh = interviewed households; χ^2 = chi square; ** = significant p≤ 0.01*

vi. *Predation (impact of predators)*

Predation was the other economically important constraint for village chicken production system of the study area. Halima (2007) also reported that predation was one of the major village chicken production constraints in North-West Ethiopia. Bell and Abdou (1995) also reported that a large proportion of village birds were being lost due to predators in some African countries.

The respondents (96.1%) of the study areas also emphasized that predators were the second most constraints of the chicken improvements. According to village chicken owners, fox were the first major and dangerous type of predators (92.1%) affecting village chicken in the study area. The attack of wild birds was very serious on young chicks (73.2%). In addition to fox, wild cats (89.4%), wild cat locally known as "Usua" or “Shelemetma” (86.6%), Hawk locally known as "Geche" or "Chilifit" (81.6%) , wild bird (kite) "Tinglie" or "Amora" (67.2) and Leopard locally known as *“Aner”* (59.8%), were the other economically important predators affecting village chicken production in the study weredas'.

The results of a study by Mekonnen (2007) in SNNPRS and Zemene (2011) from Amhara region indicated that predators are the major constraints in chicken production in their study areas. Similar results have also been reported by Conroy *et al.* (2005) from India. Scavenging chickens are vulnerable to predation as they need to leave the family dwelling to scavenge for feed (Solomon, 2008).

Table 7 : Poultry predator and control Strategy

Parameters	Study Woredas				Overall (N=232hh)	χ^2
	Damot Gale (N=59hh)	Ofa (N=60hh)	Angacha (N=54hh)	Hadero & Tunto (N=59hh)		
Presence of predators						4.17
Yes	100.0	96.7	94.4	93.2	96.1	
No	0.0	3.3	5.6	6.8	3.9	
Werekena (fox)						10.44*
Yes	83.3	96.8	91.3	100.0	92.1	
No	16.7	3.2	8.7	0.0	7.9	
Aja (Wild dog)						12.55*
Yes	69.8	100.0	0.0	100.0	75.8	
No	30.2	0.0	100.0	0.0	24.2	
Usua (wild cat)						19.1**
Yes	69.6	88.9	96.0	100.0	86.6	
No	30.4	11.1	4.0	0.0	13.4	
Zuresa (leopard)						31.46**
Yes	28.2	75.0	95.7	100.0	59.8	
No	71.8	25.0	4.3	0.0	40.2	
Geche (Hawk)						42.25**
Yes	52.9	94.9	91.4	100.0	81.6	
No	47.1	5.1	8.6	0.0	18.4	
Tinglie (kite)						14.29**
Yes	60.5	36.4	100.0	100.0	67.2	
No	39.5	63.6	0.0	0.0	32.8	
Abyssinian cat						12.15**
Yes	80.7	80.0	100.0	100.0	89.4	
No	19.3	20.0	0.0	0.0	10.6	
Control strategy of Werekena						55.37**
Look after	80.0	0.0	0.0	23.8	20.3	
Keep under basket	0.0	14.8	0.0	0.0	6.2	
Keep in the fenced compound	10.0	7.4	16.7	14.3	10.9	
Keep in the house	0.0	7.4	0.0	0.0	3.1	
Chasing and/or killing	10.0	29.6	83.3	4.8	23.4	
No control	0.0	40.7	0.0	57.1	35.9	
Control Strategy of Geche						74.55**
Look after	100.0	0.0	0.0	9.5	10.5	
Keep under basket	0.0	45.5	70.0	4.8	31.6	
Keep in the fenced compound	0.0	0.0	0.0	14.3	5.3	
Keep in the house	0.0	0.0	30.0	0.0	5.3	
No control	0.0	54.5	0.0	71.4	47.4	

*hh = interviewed households; χ^2 = chi square; ** = significant p≤ 0.01*

IV. Conclusion and Recommendations

Chicken production is an essential part of livestock production system and the results of the present study show that village chicken plays a significant role in the livelihood of the farming community in the study areas. Almost every farmer in each village practices chicken rearing to fulfill various household needs.

Newcastle disease followed by predator attack was the major constraints to chicken production in the study area. Other constraints included lack of capital and credit service to expand their chicken production, poor management practices on feeding, housing and disease control, lack of technical information and low productivity of the local chicken. Together, these factors resulted in low level of productivity and decreased the direct benefit of the farmers.

Therefore, appropriate intervention should be in chicken disease and predator control activities., breed improvement strategies, providing frequent extension services interims of regular training to farmers focusing on disease prevention, improved housing, feeding and watering of chicken, product handling and proper marketing are highly recommended so as to improve productivity of chicken and being benefited from the existing market and high demand of products. Control of diseases, mainly ND, could be achieved through improvement in veterinary and advisory services. The problem of predators could be reduced by convincing farmers to construct predator-proof separate chicken houses, especially during the night. Young chicks needed to stay in protected areas for the first 4–5 weeks of life, as this is the time when they are most vulnerable to predators and other accidents. Introduction and utilization of locally made hay—box brooders should be encouraged to provide extra care for young chicks and to reduce mortality.

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The Status of Lead and Cadmium in Supplementary Mineral Feed Source of Livestock in Ethiopia

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Keywords: *gypsum powder, lime stone, livestock, marble powder, minerals.*

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THESTATUSOFLEADANDCADMIUMINSUPPLEMENTARYMINERALFEEDSOURCEOFLIVESTOCKINETHIOPIA

Strictly as per the compliance and regulations of :

The Status of Lead and Cadmium in Supplementary Mineral Feed Source of Livestock in Ethiopia

Abegaze Beyene [α] & Anne LeLacheur [σ]

Abstract- In Ethiopia, feed industries are widely using limestone as a cheap source of Ca without adequate information on the bioavailability of its Ca content and the presence of other toxic minerals. This being the case, the present study was conducted to determine the Lead and Cadmium content of samples of limestone, Gypsum and marble powder collected from different parts of Ethiopia. Adequate quantities of lime stone, marble powder and gypsum were procured from different parts of Ethiopia and subjected to laboratory chemical analysis in triplicate. The results of this study clearly showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99%, indicating the potential use of these materials (limestone, marble powder and gypsum) collected from different part of Ethiopia as supplementary mineral feed source in very small amounts. In present work the Pb content (ppm) in Calcium-carbonate and Calcite powder previous work was(123.1± 0.06) and (65.84 ±10.87) respectively while Pb content in the present tested materials(limestone/Calcium-carbonate, marble powder, gypsum) was 24.6, 26.5 and 45.83 respectively. The two samples limestone and marble powder showed almost equal content of Pb while gypsum containing almost double of the two samples. In the present study cadmium (Cd) content in marble powder were (ppm) 2.75—3.25 (with an average of 3), the Cd content in lime stone were ranged 0.75---4.92 (with average of 2.6) In previous work Cd content in calcium carbonate and calcite powder were 6.40 ±0.00 and3.72 ±0.63 respectively, showing higher content in calcium carbonate while in the rest tested materials of the previous and the present work the content of Cd are almost the same.

In summary the results of this study showed that lime stone and marble powder widely available in different parts of Ethiopia seems to have very small amounts of Pb and Cd in supplementary mineral feed sources for livestock feeding. So the two toxic minerals are at safe level in studied samples, but testing the bioavailability of these materials with animal and identifying other toxic minerals seems to be the future direction of research.

Keywords: gypsum powder, lime stone, livestock, marble powder, minerals.

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I. Introduction

Successful animal production depends on genetic and environmental factors including nutrition and management practices. Of which nutrition plays an important role. It is believed that more than 50% of the farm expenditure or cost of animal production goes towards feeding of animals. Dietary nutrients promote programming and expression of the metabolic pathways that enables the animal to achieve its genetic production potential. All the nutrients (carbohydrate, proteins, fat, vitamins, and minerals) are equally important as deficiencies of one or more of these nutrients hamper the health status and productivity level of animals. Minerals may constitute a small fraction of the total ration but perform vital role in the body.

There is variation in the mineral content of different animal tissues. The concentrations of essential elements must usually be maintained within the narrow limits, if the functional and structural integrity of the tissues is to be safeguarded and the optimum growth, health and productivity status of the animal are to be maintained. Continuous ingestion of diets that are deficient, imbalanced or excessively high in a mineral, induce change of the normal mineral concentration of body tissues. In such circumstances the biochemical and physiological functions of the animals are affected which in turn may result in structural disorders. The developed structural disorders are variable with the mineral element concerned and its toxicity, the degree and duration of dietary deficiency, and the age, sex and species of animal involved Chesters and Arthur,(1988) Such a change could be prevented through the provision of balanced, palatable and adequate diet in desirable forms. According to McDowell et al (1993) mineral supplements differ in their bio-availability, one of the most important factors in mineral nutrition, which must be taken into consideration. Thus it is necessary to comparatively scan the available mineral supplements aimed at ensuring its adequacy and levels of toxicity incriminating minerals. This being the cases, the major objective of this research project was to study the status of Lead and Cadmium in supplementary mineral feed source of Livestock in Ethiopia .While using natural rock as potential sources of useful minerals, level of toxic minerals in it must be investigated aswell. Keeping the above in view the present study was carried out.

To study the content of **Lead** and **Cadmium** in calcium carbonate ($caco_3$) or limestone, Marble powder and gypsum obtained from different locations of Ethiopia (natural sources, cement factories etc.)

II. Materials and Methods

a) *Collection of samples*

For this study certain samples of calcium carbonate with two samples of marble powder which was wet and dry, one sample of gypsum and one sample of silica powder were procured from different sources/ locations (Efforts were made to procure as many batch samples as possible. The detail is given in table 2.1.

b) *Analysis of samples*

The samples that had been collected from various sources were analyzed in triplicate for dry matter (DM), total ash, acid insoluble ash (AIA), , toxic elements like Pb and Cd were analyzed. Total ash and AIA were analyzed by the method of AOAC (2002). Toxic minerals such as Cd and Pb were analyzed using AAS (Atomic Absorption spectrophotometer) AOAC. (2002).

Table 2.1 : Sources of calcium carbonate, Gypsum, Marble powder & silica

Sr No	Date of collection	Name of samples	Place of collection
1	17/07/2013	Marble powder(wet)	Addis marble factory
2	17/07/2013	Marble powder(dryt)	Addis marble factory
3	17/07/2013	Calcium carbonate	Amhara (Gojam) filiklik Abyssinia cement factory
4	17/07/2013	Calcium carbonate	Amhara (North showa) Jamma Abyssinia cement factory
5	17/07/2013	Gypsum	Amhara (Gojam) filiklik Abyssinia cement factory
6	17/07/2013	Calcium carbonate	Oromia (Durba)Mugar cement factory
7	17/07/2013	Silica powder	Oromia (Durba)Mugar cement factory
8	17/07/2013	Calcium carbonate	Oromia (Durba)Mugar cement factory
9	18/07/2013	Calcium carbonate	Hung shan Mojo cement factory (Hirna from Harrar)

i. *Analytical procedures*

a. *Processing of minerals supplement samples*

1 gm of dried mineral supplements sample were taken in silica basin and charred to remove smoke and ashed at 550°C in a muffle furnace for two hrs. Acid extract was prepared by quantitative transfer ash to a dried clean glass beaker to which 20 ml of 5 N HCl was added this was boiled for 5 minutes and filtered through what man filter paper No. 42 into 250 ml volumetric flask. The filter paper was washed with hot distilled water until free of acid; the volume was made to the mark with distilled water. This extract was used for analysis of Pb and Cd.

b. *Estimation of Pb and Cd*

Toxic minerals (Pb and Cd) will be estimated by atomic absorption spectrophotometer (AAS) using acetylene as fuel and air as oxidant, specific hallow cathode lamps were used for the determination of each element. After adjusting the instrument, the standards and unknown will be monitored through the samples spraying device to get the constant reading in the digital display The detail of preparation of standard solutions for various elements is shown in table2.2.

Table 2.2 : Preparation of standard solutions for lead and cadmium

Element	Salt	Quantity in mg will be made to 100 ml with distilled H_2O	Yield	Standard range
Lead	$(CH_3COO)_2Pb.3H_2O$	18.49	100 ppm	2.0-20 ppm
Cadmium	$CdCl_2$	16.81	100 ppm	0.6-6.4 ppm

Stock solution containing 100 ppm of Pb and Cd were prepared by taking the accurately weighed amount of each salt and making the volume as indicated in table 2.2.

III. Results and Discussion

Total Ash and Acid Insoluble Ash

The total ash, AIA, Pb and Cd contents of the limestone, marble powder, gypsum and silica collected from different part of Ethiopia are given in Table 3. According to Kabaija and Little (1993), the total ash content of most of the Ethiopian common animal feed is equal or lower than 12%. Total ash content of 10-12% and 4.6-8.7% was reported from range grasses and highland hays of Ethiopia respectively. The highest total ash content of 12% was reported from Chrysopogon *aucheri* grown in the highland of Ethiopia. According Table 3, total ash content of 99% was recorded from

Addis Marble powder, Jamma Limestone (Abyssinia Cement), Durban Silica Mugger Cement, Durban limestone cement factory and from Hirna limestone hungshan cement factory, the value of which is very high compared to the others. The lowest total ash content of 81% was recorded from Durban Gypsum cement. The results of this study clearly showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99% (on dry matter basis), indicating the potential use of these materials (limestone, marble powder and gypsum collected from different part of Ethiopia) as supplementary mineral feed source in a very small amounts.

Acid Insoluble Ash content of animal feed seems to receive adequate attentions. The BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability. Ammerman et al (1984) reported that high levels of AIA in the ration of livestock depressed the utilization of P and certain other micronutrients. Kabaija and Little (1993), reported ADF ash content of 3-5% from common Ethiopian animal feeds. ADF ash content of range grasses ranged between 4.06 and 7.61%. It is reported that high levels of ADF ash in animal feed negatively affect digestibility. It is also reported that the high levels of ADF ash in animal feed could be attributed to the presence of large amounts of silica which in turn may seriously reduce digestibility *Van Soest* (*1982*) .The result of this study showed that Durban Silica Mugger Cement contain 96 % Acid Insoluble Ash which makes it unfit as animal feed because of its insolubility. Jamma limestone, Durban gypsum Mugger and filiklik limestone Gojam contain 4.2-8.3% Acid Insoluble Ash, the values of which are high for the use as animal feed compared to the others. On the other side (Table 3) the Acid Insoluble Ash content of the others (Limestone Abyssinia cement factory(Jamma), Limestone Durban cemnt factory (Durba), Limestone Hungshan cement factory (Hirna)) ranged between 0.29 and 3.29%, the values of which are lower than that reported from the Ethiopian highland range grasses and straw based dry period roughage feeds. Therefore, the results of this study clearly showed that Limestone from durba, Limestone (Jamma) and Limestone (Hirna) could be used as mineral supplant in livestock feeding based on their percent composition of Acid Insoluble Ash.

Table 3 : Total ash, AIA(on percent DM basis)and Toxic content in gypsum, lime stone and marble powder (ppm)

SAMPLE N0	Places of collections	DM %	AIA % of DM	Total ash	Pb ppm	Cd ppm
1	Marble powder (wet) *Addis marble factory	99.73	1.09	99.31	32.5	3.25
2	Marble powder(dry) *Addis marble factory	99.78	1.33	99.39	20	2.75
3	Lime stone Gojam (Filiklik)*Abyssinia cement factory	0.08	8.29	97.12	20	0.75
4	Limestone Abyssinia cement factory(Jamma)	99.73	3.27	98.69	32.5	2.83
5	Limestone Abyssinia cement factory(Jamma)*	82.07	4.24	77.16	20	2.08
6	Gypsum Mugger cement factory (durba*)	99.49	8.43	97.27	45.83	3
7	silica Mugger cement factory (durba)*	99.96	95.72	99.58	15.83	2.25
8	Limestone durban cement factory (dubra)*	98.40	0.29	97.70	2.25	2.42
9	Limestone hungshan cement factory (Hirna)*	99.89	3.29	99.20	48.33	4.92

*N.B. * Wet, –While cutting the marble in the factory they are pouring water (wet)*

**Dry- While cutting the marble in the factory without pouring water (dry)*

** This are local names where the respective factories are taking the row materials (lime stone, gypsum or marble powder*

NO 7. Silica cannot be used as feed its content is analyzed just for curiosity only.

Limestone and calcium carbonates are the same

a) Lead (Pb)

Lead (Pb) occurs naturally in the environment, but its industrial use (e.g. mining, smelting, processing, se in plumbing solders and alloys, pigments, batteries, ceramics, etc.) has resulted in increased levels in soil, water and air [6, 12]. Inu the past, leaded fuel was important contributor to lead in the environment. However, with the introduction of unleaded fuel in the mid 1980's, lead has considerably decreased in the environment. Lead accumulation in soils and surface waters depends on many factors, including pH, mineral composition, and amount and type of organic material. Lead in soil is transferred to food crops.

Animal exposure to lead can occur via food, water, soil, dust and air. Lead exists both in organic and inorganic forms. *Bampidis V.A. et al.* 2013, 46 (1)

The source of lead includes natural and anthropogenic processes such as combustion of coal and mineral oil, smelters, mining, alloy processing units, paint industries etc. Newly born animals are particularly susceptible to lead exposure due to high gastrointestinal uptake and the permeable blood brain barrier leading to neurotoxic effects even at low exposure (Allcroft and Blaxter, 1950). It is the most common industrial metal that has become widespread in air, water, soil and food and easily accumulates in the different vital organs especially liver, kidney, bones and brain of the body. Besides, direct ingeS tion of lead which causes increased blood lead levels, accumulated lead in the body also acts as a significant source of blood lead burden (Swarup *et al.*, 2005).

Lead (Pb) is toxic to the blood, nervous, urinary, gastric and genital systems [1,11,14]. Furthermore, it is also implicated in causing carcinogenesis, mutagenesis and teratogenesis in experimental animals [1]. Lead readily crosses the placenta and there is evidence that exposure to high levels increases the risk of spontaneous abortion, miscarriage and stillbirth [11] AG Dawd1 *et al.* (December, 2012).

In present study the Pb content in different natural rock samples procured from different parts of Ethiopia **(Table 2.1)** such as marble powder ranged **20—32.5** an average of **26.3** ppm, in limestone ranged **2.25—48.33** an average of **24.6 ppm**, and in gypsum **45.83** ppm.

Maximum tolerable levels of Pb in the feed(mg/kg or % of the DM of animals is for cattle 100 mg/kg ,for sheep 100 mg/kg, so in all samples the content of Pb is at safe level and no danger in using the natural rocks as mineral supplements..

b) Cadmium (Cd)

Chronic cadmium intoxication has been observed in calves receiving daily 18 mg Cd/kg BW, in sheep receiving daily 60 mg Cd/kg of diet for 137 days, and in pigs receiving daily 50 mg Cd/kg of diet for 42 days. However, minimum toxic levels or maximum safe dietary concentrations cannot be estimated with any precision, since cadmium disposition is significantly influenced by dietary interactions with zinc, copper, iron and calcium. Thus, in some cases, concentrations of cadmium as low as 1mg/kg in the diet or drinking water did induce adverse effects in animals. These effects included renal function impairment, hypertension, disturbance of trace mineral metabolism (copper, zinc and manganese), and acute degenerative damage in the intestinal villi *Bampidis V.A. et al.(* 2013, 46 (1)*)* Cadmium is a toxic to virtually every system in the animal body. It is almost absent in the human body at birth, however accumulates with age. An average man accumulates as about 30 mg cadmium in his body by the age of 50 years. Refined foods, water foods, water pipes, coffee, tea, coal burning and cigrates are all the most important source of Cd. Daily dietary intake of Cd ranges from 40-50 µg/ day [51]. Cadmium accumulated with in the kidney and liver over long time [32]. It is interact with numbers of minerals mainly Zn, Fe, Cu and Se due to chemical similarities and competition for binding stage. It is also reported that Cd can affected Ca, P and bone metabolism in both industrial and people exposed to Cd in general environment [23]. Tibebu Kocharea, BerhanTamirb *(2015).*

Sewage sludges contain variable and occasionally excessive cadmium concentrations (up to 20 mg/kg DM) (ASTDR, 1999).

Abegaze Beyene (2008) has reported the **Cd** content in calcite powder **3.72 ±0.63** ppm and in calcium carbonate **6.40±0.00** ppm in samples collected from different parts of India.

In present study the Cd content in different natural rock samples procured from different parts of Ethiopia **(Table 2.1)** such as marble powder an average of 3 ppm, in limestone an average of 2.6 ppm, and in gypsum 3 ppm. In all samples the content of Cd is at safe level and no danger in using the natural rocks as mineral supplements.

IV. Conclusions

Samples of lime stone powder ($CaCo_3$) powder were collected from different parts of Ethiopia were subjected to laboratory chemical analysis in triplicates. The results obtained showed that the total ash content of all the materials analyzed in this study ranged between 81 and 99% (on dry matter basis), indicating the potential use of these materials (limestone, marble powder, gypsum and silica collected from different part of Ethiopia) as supplementary mineral feed source in a very small amounts. The Acid Insoluble Ash content of limestone from Abyssinia, cement factory (Jamma), Limestone Durbacemnt factory.(Durban), Limestone Hungshan cement factory (Hirna)) ranged between 0.29 and 3.29%, the values of which are lower than that reported from the Ethiopian highland range grasses and straw based dry period roughage feeds. Therefore, the results of this study clearly showed that Limestone from durba, Limestone(Jamma) and Limestone(Hirna) could be used as mineral supplant in livestock feeding based on their percent composition of Acid Insoluble Ash. According to the results of this study, the(AIA) Acid Insoluble Ash content of limestone from Gojam (Filiklik)*Abyssinia cement factory and Gypsum Mugger cement factory (durba*)is very high those samples coudnot be used as mineral supplement as BIS (2002) restricted Acids Insoluble Ash content to 2.5 to 3.0%in the final mineral mixtures as high levels of AIA lowers the utilization of nutrient and palatability The results obtain showed that the content of the test materials are comparable to that of the common Ethiopian animal feed stuffs .

Lead and cadmium is at low level and can be used confidently However, other toxic minerals and animal evaluation of the bioavailability of the test materials seems to be the future direction of research.

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Global Journal of Science Frontier Research (D) Volume XV Issue IX Version I Year 2015

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Efficacy of Foliar Nutrition on Vegetative and Reproductive Growth of Sunflower (*Helianthus Annuus* L.)

By Tegegnework Gebremedhin, Shanwad U. K, Wubayehu Gebremedhin & A. Anantha Rama
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Abstract- The study showed the significant efficacy of foliar application of macro and micronutrients along with the soil test crop responses on all the parameters of sunflower (*Helianthus annuus* L.) Among nine treatments under study, treatment T_9 (STCR approach + Foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%) recorded maximum height of plants (191.7cm), number of leaves per plant (22.17), leaf area (17.32 dm^2), stem girth (9.97 cm), minimum days to flowering (54), head diameter (28.14 cm) and total dry matter accumulation (108.07 g $plant^{-1}$) followed by the treatment T_3: STCR approach (Yield target: 25 q/ha) and T_8: Soil test based NPK (STL) + Foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%. The stem girth (9.97 cm) was found maximum in T_9 followed by the treatment $T_{3.}$ Maximum gross returns (Rs. 65,257 ha^{-1}), net returns (Rs. 42,105 ha^{-1}) and B: C ratio (2.82) was found with T_9 (STCR approach + Foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%).

Keywords: *sunflower nutrition, STCR, STL, foliar.*

GJSFR-D Classification : *FOR Code: 309999p*

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Tegegnework Gebremedhin [α], Shanwad U. K [σ], Wubayehu Gebremedhin [ρ] & A. Anantha Rama [ω]

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I. Introduction

Sunflower (*Helianthus annuus L.*) is grown in different agro climatic zones of the world, differing in soil nutrient status. The use of foliar fertilizing in agriculture has been a popular practice with farmers since the 1950s, when it was learned that foliar fertilization was effective and economic. Its purpose is not to replace soil fertilization, but rather to supplement plant nutrient needs during short and/or critical growth stages. Foliar feeding is intended to delay natural senescence processes shortly after the end of reproductive growth stages. Recent research has shown that a small amount of nutrients, particularly Zn, Fe, B and Mn applied by foliar spraying increases significantly the yield of crops (Sarkar *et al.*, 2007; Wissuwa *et al.*, 2008, Asad *et al.*, 2002). Also, foliar nutrition is an option when nutrient deficiencies cannot be corrected by applications of nutrients to the soil (Sarkar *et al.*, 2007; Cakmak, 2008). It is likely therefore, in open-field conditions, where the factors that influence the uptake of the nutrients are very changeable, foliar fertilization can get considerable importance. Among the micronutrients, Zn and Fe nutrition can affect the susceptibility of plants to drought stress (Sultana *et al.*, 2001; Cakmak, 2008).The highest rate of Boron foliar fertilization resulted in leaf burn but had no other evident detrimental effect on plant growth. Under B-deficient conditions, Boron foliar application increased the vegetative and reproductive dry mass of plants. Iron plays essential roles in the metabolism of chlorophylls. External application of Fe increased photosynthesis, net assimilation and relative growth in seawater-stressed rice (Sultana *et al.*, 2001). This is especially true for soils of high pH where equilibrium conditions favour the oxida- absorption of plant-available Fe^{+2} to unavailable Fe^{+3}. Plant yield on many soils is, therefore, limited by poor Fe availability, rather than a low Fe content in the soil (Ahmad, B. and Garib, M., 2010).

Foliar feeding of nutrients has become an established procedure to increase yield and improve the quality of crop products (Romemheld, 1999). This procedure improves nutrient utilization and lower environmental pollution through reducing the amount of fertilizers added to soil. Foliar feeding of nutrients may actually promote root absorption of the same nutrient or other nutrients through improving root growth and increasing nutrients uptake (Saqib *et al.*, 2006). Foliar application of nutrients is in advance more significance in fertilization of various field and floricultural crops, in many countries. The advantages of foliar fertilizers were more noticeable under growing conditions restricting the incorporation of nutrients from the soil (Verma, 2003).Foliar fertilization method may also be a good substitute to the predictable soil application to avoid the loss of fertilizers by leaching and thereby minimizing the ground water pollution (Tomimori *et al.*, 1995). Zinc plays an important role in the production of biomass (Cakmak, 2008). It may be required for chlorophyll production, pollen function, fertilization. The purpose of this study is to understand the effect of foliar fertilization of micro nutrients along with the different basal fertilizer application on the vegetative and reproductive growth of sunflower.

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II. Material and Methods

a) *Description of the site*

The experiment was conducted on the research farm of Main Agricultural Research Station of North Eastern Dry Zone (Zone-2) of Karnataka, Raichur, India at 16° 15' N latitude and 77° 20' E longitude with an altitude of 389 meters above mean sea level during 2013 growing seasons. Site of study has cold winter and very hot summer. The yearly average precipitation 50-years long term period) which is mostly occurred during the spring months is 681.2 mm. The mean annual average maximum and minimum temperature was 33 and 21.5°C respectively.

b) *Soil sampling and analysis*

Prior to the beginning of experiment, soil samples were taken in order to determine the physical and chemical properties. A composite soil samples were collected at a depth of 0-30 cm. It was air dried, crushed, and tested for physical and chemical properties. The research field had a clay loam soil. Details of soil properties are shown in (Table 1).

Table 1 : Physical and chemical properties of the soil used in the study (0-30 cm)

Textural class	Clay loam
Soil PH	7.69
Ec (dsm-1)	0.36
CEC (c mol (p+) kg-1)	48.2
Organic carbon (%)	0.62
N (kg ha-1)	234.28
P2O5 (kg ha-1)	39.78
K2O (kg ha-1)	405.02
Mn (ppm)	11.9
Fe (ppm)	3.94
Zn (ppm)	0.26
CU (ppm)	1.01

c) *Field preparation and Treatment allocation*

After plough in fall and two disks in summer, the land was flatted by leveler and then plots were prepared. The experimental design was laid out in a Randomized Complete Block Design with three replications. The treatments involved were, T_1 - Recommended NPK as per POP (90:90:60 N P K kg ha^{-1}), T_2 - Soil test based NPK (STL method), T_3 - STCR approach (Yield target: 25 q/ha), T_4 - Foliar spray of nutrients NPK (19:19:19 @ 1% spray at 15, 30, 45 and 60 DAS) + Zn (0.5%) and Fe (0.5%) sprays at 30, 45 and 60 DAS + B (0.2%) sprays at 50% flowering, T_5 - T_1 + T_4, T_6 - 75% Recommended NPK + T_4, T_7 - 50% Recommended NPK + T_4, T_8 - T_2 + T_4, T_9 - T_3 + T_4 where in RDF: Recommended Dose of fertilizers and STCR: Soil Test Crop Responses.

The net plots had 4.8 m length and 4.8 m width consisted of 8 rows, 0.6 m apart between all plots, 1 m distance was kept to eliminate all influence of lateral water movement. NPK (19:19:19) was applied @ 5 kg ha^{-1}, Zn and Fe were applied in the form of ZnSO4 and FeSO4 @ 2.5 kg ha^{-1} and finally Boron was applied @ 1 kg ha^{-1} as foliar application to the treatment details. According to results of soil analysis 102.5:90:60 N: P_2O_5:K_2O kg ha^{-1}, 96:165:57: N, P_2O_5, K_2O kg ha^{-1} and for RDF 90:90:60 kg ha^{-1} Basal dose of fertilizer for T_2, T_3 and T_1 respectively was used. All of diammonium phosphate (DAP) and one third of urea were distributed in plots and mixed with surface soil before seed sowing. Rest of urea was used at 30 DAS.

III. Result and Discussions

a) *Growth Parameters*

The data revealed that the efficiency of foliar application of both macro and micro nutrient fertilizers along with different basal fertilizer application methods affected growth parameter like plant height, number of leaves, leaf area and stem girth of Sunflower as shown in (Table 2). Significant difference in the plant height, number of leaves, leaf area and stem girth was recorded due to application of foliar nutrition long with of soil test crop response basal fertilizer application. The treatment T_9 recorded the maximum plant height (191.7cm), number of leaves per plant (22.17), and leaf area (17.32 dm^2) followed by T_3 (185cm), (21.17) and (16.76 dm^2) and T_8 (182.67 cm), (18.62) and (16.77 dm^2) of plant height, number of leaves and leaf area , respectively and the maximum stem girth was on T_9 (9.97 cm) followed by T_3 (9.26 cm) which differed significantly from each other as well from other treatments.

The higher plant height might be attributed to increased efficiency in nutrient availability resulting in prolonged greenness and larger leaf surface as indicated by the result at all the growth stages. Similar results were reported by Elnaz *et al*. (2010). The Plant height due to the enhancement of auxine biosynthesis and synergetic relation between iron and nitrogen the significantly lower growth parameter was noticed on the treatment T_4 (solely foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%) because providing only foliar nutrition might not have fulfilled the crop demand. The better performance of sunflower with the increased nourishment of soil test crop response along with foliar spray of micro nutrient may be due to the greater availability of nutrients and Foliar fertilization is theoretically more immediate and target- oriented than soil fertilization since nutrients can be directly delivered to plant tissues during critical stages of plant growth (Fernández and Brown, 2013). The present findings are in consonance with that of Ramachandrappa and Najappa (2005). The result were identified by Kassab (2005) confirmed the significant effect of micronutrients in growth parameters including yield in mung bean plants by foliar application.

b) Reproductive Parameters

The data revealed that the efficiency of foliar application of Nutrients along with different basal fertilizer application methods affected various flowering and flower head parameters as shown in (Table 3). The treatment, T_9 (STCR approach + Foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%), T3 (STCR approach), T8: (Soil test based NPK + Foliar spray of NPK @ 1% + ZnSO4 @ 0.5% + FeSO4 @ 0.5% and B @ 0.2%) and T_2 (Soil test based NPK) were noticed early flowering ranges between (54 and 55 DAS) as compared to all other treatments. The treatment T_9 recorded the maximum flower head diameter (28.14 cm), followed by T_3 (26.53 cm) and T_8 (25.47 cm) which differed significantly from each other as well from other treatments. This may be due to considerably higher and balanced levels of fertilizer application. These results are in line with the work of Osman *et al*. (1980) and Akram (1989) who reported that nitrogen alone or in combination with phosphorous and potash increased head diameter over the control. Wang *et al.,* (2003) observed that boron plays an essential role in pollen germination and pollen tube growth in *Picea meyeri*.

Table 2 : Effect of foliar nutrition along with different basal fertilizer application methods on different vegetative growth parameters of sunflower

	Treatments	Plant height (cm)	Number of leaves	Leaf area (dm^2)	Stem girth (cm)
T_1	RDF (control)	174.4	15.83	15.4	8.17
T_2	Soil test based NPK (STL method)	180.34	17.78	15.5	8.84
T_3	STCR approach (Yield target: 25 q/ha)	185	21.17	16.76	9.26
T_4	Foliar spray of NPK + $ZnSO_4$ + $FeSO_4$ and B	165	11.53	11.73	7.43
T_5	T_1 + T_4	174.67	16.41	15.43	8.35
T_6	75% RDF + T_4	171	15.74	15.11	7.95
T_7	50% RDF + T_4	167	14.96	14.58	7.6
T_8	T_2 + T_4	182.67	18.62	16.77	8.93
T_9	T_3 + T_4	191.7	22.17	17.32	9.97
	S.Em±	2.8	1.18	0.47	0.32
	C.D. at 5%	8.4	3.56	1.42	0.96

Table 3 : Effect of foliar nutrition along with different basal fertilizer application methods on the total dry matter accumulation and reproductive parameters of sunflower

	Treatments	Days to 50% flowering	Head diameter (cm)	Total dry matter accumulation (g plant-1)
T_1	RDF (control)	56	22.27	95.9
T_2	Soil test based NPK (STL method)	55	24.17	98.4
T_3	STCR approach (Yield target: 25 q/ha)	54	26.53	103.27
T_4	Foliar spray of NPK + $ZnSO_4$ + $FeSO_4$ and B	58	19.03	86.89
T_5	T_1 + T_4	56	23.27	97.07
T_6	75% RDF + T_4	57	20.33	94.63
T_7	50% RDF + T_4	57	19.43	91.73
T_8	T_2 + T_4	54	25.47	101.6
T_9	T_3 + T_4	54	28.14	108.07
	S.Em±	0.5	1.12	1.74
	C.D. at 5%	1.6	3.38	5.23

Global Journal of Science Frontier Research (D) Volume XV Issue IX Version I Year 2015

c) Total Dry matter Accumulation in sunflower

The data revealed that the efficiency of foliar nutrition along with different basal fertilizer application methods affected the total dry matter production and its accumulation (Table 3).

The treatment T_9 recorded the maximum total dry matter accumulation (108.07 g plant^{-1}), followed by T_3 (103.27 g plant^{-1}) which differed significantly from each other as well from other treatments. Significantly lower total dry matter accumulation (86.89 g plant^{-1}) was recorded with T4 (foliar spray of NPK @ 1% + ZnSO4 @ 0.5% + FeSO4 @ 0.5% and B @ 0.2%). The increased total dry matter accumulation may be attributed to greater accumulation of photosynthates by vegetative parts in the plants having micronutrient application. Similar results were also reported by Thiyageshwari and Ramanathan (2001) in tomato, Movahedi-Dehnavi *et al.* (2009) and (Mohammad, G., *et al*., 2012) which they indicated the Positive effect of micronutrient elements on biological yield of safflower. The application of micronutrients favoured the accumulation of even macronutrients due to their role in activation of enzymes, involved in metabolic processes.

IV. Conclusion

On the basis of present study, it is concluded that the application of STCR approach + Foliar spray of NPK @ 1% + $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and B @ 0.2%) resulted in maximum plant height, number of leaves per plant, leaf area, stem girth, flower head and early days to 50% flowering. Therefore we can conclude that plant which received foliar nutrition along with different basal soil test crop response fertilizer application to nutrient exhaustive crops like sunflower show significant results as compared to those other treatments. Micro nutrients uptake are controlled by the two major factors, availability of these elements in the soil and the ability of plants to acquire them. Application methods of micronutrients are very important to attain the best absorption. Sometimes response of the plants is different to application methods of fertilizers, for example in calcareous soil Fe and Zn are not available for plants, under such situations, foliar application is a useful method for best use of nutrients in plants like sunflower crop.

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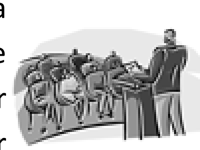

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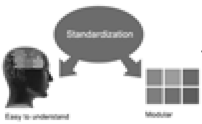

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Institutional Fellow of Global Journals Incorporation (USA)-OARS (USA)

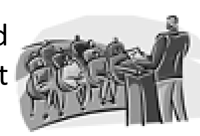
Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.
The author fees of such paper may be waived off up to 40%.



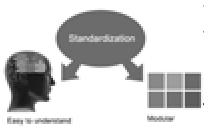
The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



After nomination of your institution as “Institutional Fellow” and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

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We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

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- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

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- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
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- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

"

- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

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Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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Original research paper: Such papers are reports of high-level significant original research work.

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Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

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(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

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(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

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Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

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Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.
- Do not give permission to anyone else to "PROOFREAD" your manuscript.
- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation)
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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

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