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## Research Article

# Engine driven feed chopper technology demonstration for animals' feed preparation in the selected districts of AGP-II in Harari region and Dire Dawa Administration

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## Abstract

Animal feed preparation in very quality and good enough quantity way in short period time helps small holder farmers to feed their livestock in good manner. To make this animal feed preparation demonstrating Feed Chopper Machine which is hay cutting machine that use for uniform chopping of fodder for livestock's feed is good option. Thus, demonstration of feed chopper was undertaken with objectives of demonstrate and evaluate engine driven feed chopper technology, create awareness among farmers, developmental agents, subject matter specialists and other participant stakeholders on engine driven feed chopper technology and build farmers' knowledge and skill of production and management of the enterprises. A total of 80 trial farmers were selected from Sofi and Wahil potential sorghum and maize growing kebeles and training was given for participants on how to use the machine for livestock feed forage chopping. The machine could chop time of chopping 0.03hr, chopping efficiency 95%, Wt of off cut length 19 to 31.54 %. Output capacity 88.24 kg/h, and also the machine ensure safety of feed, provide good fodder for animal, save work time, and get protection of feed from dust and make the feed easily palatable. And there was statistically significance difference of parameters related with stalk that is moisture content at  $p < 5\%$ , output capacity, chopping efficiency and chopping rate at  $p < 1\%$ . Therefore, it is better to work on the multiplication and promotion of this engine driven feed chopper technology by government, Non-government and other stakeholders to small holder farmers in the study areas and other places.

## Introduction

Crop residue has become the used term in tropical research and development circles for describing the fibrous by-products of cereals, sugarcane, roots and tubers, pulses, oilseeds, oil plants, vegetable and fruits. With notable exemptions e.g. sugar beet pulp and citrus pulp, utilization of residues as feed has been the subject of intense research and development since the mid-1970s [1]. All ruminants depend on two major feed resources. These are crop residues and agro-industrial by-products and they play significant role in the nutrition of ruminant animals [2]. Crops residues are distinct from agricultural by-products (such as bran, oil cakes etc.) which are generated when crops

are processed. Generally, any plant materials that remain after food crops have been harvested are classified as a crop residue.

Apart from being a source of animal feed, residues are used as building, in the case of wheat, oat or barley straws; as building material for walls of local houses, roofing and sorghum and maize used for fencing materials, as fuel or surface mulch in crop land [3]. Goats, sheep and cattle are constantly faced with problem of feed shortage during the dry season. The herd constantly relies on crop residue, but these are usually in short supply. Hence ruminants experience seasonal weight gain/loss during the wet/dry periods respectively during the year [4]. Utilization of stalks and stovers of cereal crops is sure



to improve the availability of the product. Ruminants despite their unique and highly efficient digestive system are not able to extract sufficient energy to grow and produce milk from low quality or high lignified residues. Hence these must be properly processed or treated in some way to make them useful for production [5].

A Feed Chopper is mechanical device used to cut the straw or hay into small pieces so as to mix it together and fed to cattle. This improves animal digestion and prevents animal from rejecting any part of their food. So, to increase the productivity and reduce the physical effort required for running the machine and motorized machineries came into existence, it is best for dairy farmers. Presently fodder cutting machines are electric driven as well as hand operated or engine driven [6]. Therefore, this activity was aimed at demonstrating and evaluate engine driven feed chopper technology to the target area with the following objectives.

### Objective

To demonstrate and evaluate engine driven feed chopper technology under farmers' condition,

To create awareness among farmers, developmental agents, subject matter specialists and other participant stakeholders on engine driven feed chopper technology,

To build farmers' knowledge and skill of production and management of the enterprise and strengthen linkage among stakeholders.

### Materials and methods

This engine driven feed chopper technology demonstration was conducted in selected districts of Harari region and Dire Dawa administration.

#### Site selection

Research sites were selected purposively based on the potentiality of livestock production and feed resources, and access to road, accordingly Kile kebele from Sofi and Wahil kebele from Dire Dawa were selected.

#### Farmers selection

Farmers were selected based on their interest, innovation he/she has in using feed chopper production and willingness to use the technology in collaboration with the Development Agents. The selected farmers were grouped in form of Farmers Research Group (FRG) with the member of 40 farmers per kebeles in consideration of gender issues (women and men). In the establishment of FRG in the study areas total of 4FRGs (2FRG/ kebele) from one kebele 40 farmers and a total of 80 farmers were grouped in 4FRG Table 1.

#### Data collection

Quantitative data were collected by data sheet tools at time of operating the machine in chopping animal feed forages at farm level. As depicted on Table 3 these listed parameters were

recorded by using different tools, for example for weight we used balance material designed by different scales, for time of chopping we used starting time and finishing time; for chopping efficiency we used by counting the chopped stalk and not chopped then recorded the result by percentages; moisture content by prepared material that helps us to measure moisture content in dry and wet stalk of the maize and sorghum and qualitative data were collected through personal field observation, individual interview, and focus group discussion by using checklist. This Engine Driven feed chopper technology was developed by Fadis Agricultural Engineering Research Directorate, Oromia Region, Ethiopia country and its model is FARC-2019 AGP-II supported feed chopper.

### Data analysis

Quantitative data was summarized using simple descriptive statistics (average, mean, t-test, frequency and percentage) while the qualitative data were analysed using analyzed using narrative explanation pair-wise ranking and direct matrix.

## Results and Discussion

### Training of farmers and other stalk holders

Multidisciplinary research team; Agricultural Mechanization researchers, extension and socio-economic research team and other stakeholders (Offices of Agriculture and Natural Resource) actively participated by sharing their experience and knowledge and journalists in publicity of the work done, Development Agents, experts and farmers were participated on the training given on feed chopper theoretical and practical training, management, and post-harvest handling Table 2.

Among the training participant stakeholders, 81.25% were farmers. From those farmers, 38.46% are female farmers' participant. Different extension materials were utilized and distributed for the participants. For those individuals, 30 leaflets and 20 small manuals on the technology in Afaan Oromoo (local) and English languages were distributed Table 3.

### Farmers' Opinion/Perception

The opinion of those farmers on the machine performance was collected from participants during variety demonstration.

**Table 1:** Selected site and farmers.

Kebeles	Number of Trial Farmers	Male	Female
Wahil	40	27	13
Kile	40	30	10
Total	80	57	23

**Table 2:** Number of participants on training.

No.	Participants	Male	Female	Total
1	Farmers	40	25	65
2	Development Agents	7	0	7
3	District experts	4	1	5
4	Journalists	3	0	3
	Total	54	26	80



The major criteria used by farmers were time of chopping (hr), chopping rate, chopping efficiency, output capacity by observing the machine during its operation. Therefore, most farmers preferred the machine. The following Table describes farmers' selection criteria and their perception (feedback) toward the machine Tables 4,5.

## Discussion

The feed choppers engine driven was evaluated by farmers based on traits the implements behave for both sorghum's and maize's dry and wet stalk. Accordingly, the engine driven feed chopper showed that good efficiency 88.2%-95.33%, chopping rate 66.17 kg/hr to 87.85kg/hr, and output capacity from 75.00 kg/hr to 92.15kg/hr and moisture content from 18.2% to 63.5%. This indicates that the machine has more advantage in efficiency, saving time for farmers in chopping, prepare feed in good quality without much loss and conserve the moisture content of forage that is sorghum and maize stalk. There were statistically significance differences among parameters towards the stalks that is output capacity, chopping rate and chopping efficiency of this engine driven feed chopper was statistically significant at  $p < 1\%$  while moisture content was significant at  $p < 5\%$  as depicted on Table 6. This shows that this machine is very important for small-holder farmers in solving the problems of chopping efficiency and preparing quality feed for their livestock in areas where these parameters are being issue.

Moreover, this technology was selected by farmers in consideration of traits the implement owns like chopping efficiency and other traits as shown on the Table 5 above, as a result, they preferred the technology chopping efficiency ranked first, output efficiency second, time of chopping, chopping rate and labor use third, fourth and fifth respectively. This indicates that in potential producers of livestock areas this technology is indispensable option in preparing good quality

**Table 3:** Performance of the machine.

No	Parameters	Feed Materials			
		Sorghum Stalk		Maize Stalk	
		Wet	Dry	Wet	Dry
1	Average weight of input (kg) W1	3	3	3	3
2	Average weight of feed Output (kg) W2	2.85	2.65	2.86	2.85
3	Average weight of material in the chamber (kg) W3	2.4	3.5	1.4	2.4
4	Time of chopping (hr)	0.03	0.040	0.03	0.03
5	Chopping rate kg/hr	83.82	66.17	87.85	83.82
6	Chopping efficiency (%)	95.00	88.2	95.33	95.00
7	Wt. of off cut length (%)	19	26	31.54	19
8	Fuel consumed (liter/hr)	0.7	0.98	0.65	0.7
9	Output capacity (kg/hr)	88.24	75.00	92.15	88.24
10	Moisture Content % (db)	19.1	63.5	18.2	19.1

**Table 4:** Ranks of the feed choppers based on farmers' selection criteria.

Implement	Farmers rank	Reasons
Engine driven feed chopper	1 <sup>st</sup>	Better Chopping efficiency, less time of chopping, high chopping rate, high output capacity, reduce labor use
Traditional chopping	2 <sup>nd</sup>	Low chopping efficiency, extended time of chopping, low chopping rate, low output capacity, maximize labor use

**Table 5:** Pair-wise ranking matrix result to rank variety traits.

Code no.	Traits	Chopping efficiency	Time of chopping	Chopping rate	Output capacity	labor use	Frequency	Rank
1	Chopping efficiency		1	1	1	1	4	1 <sup>st</sup>
2	Time of chopping			2	4	2	2	3 <sup>rd</sup>
3	Chopping rate				4	3	1	4 <sup>th</sup>
4	Output capacity					4	3	2 <sup>nd</sup>
5	labor use						0	5 <sup>th</sup>

**Table 6:** Paired Samples Test.

Stalk with parameters (Paired test)	Paired differences			
	Mean	Std. Deviation	t-value	Sig.
Moisture content	28.47500	22.02126	2.586	.081***
Output capacity	84.40750	7.89459	2.384	.000***
Chopping efficiency	91.88250	3.83030	4.977	.000***
Chopping rate	79.91500	10.63496	5.029	.001***

\*\* Significance at  $p < 5\%$  and \*\*\*\* significance at  $p < 1\%$  Source: Own computation, 2020

feed for livestock in good condition and timely providing the feed in short period of time and labor saving and this technology is very appropriate for chopping fodder like elephant/Napier grass for enhancement of food security for human and feed forages for livestock [5]. Therefore, based on these results obtained the following conclusion and recommendations are derived [7].

## Conclusion and recommendations

This research activity found that the engine driven feed chopper was very effective than the traditional copping in terms of different traits like time of chopping, output capacity and conservation of the content in maize and sorghum stalk. As a result, farmers selected the engine driven on the first rank because of the chopping efficiency, time chopping, moisture conservation and other traits. Therefore, it is recommended to works on further promotion, multiply the machine and distribute to small holder farmers in the study areas and other places.

### Contribution of authors

Abdulaziz Teha- collected, entered and analyzed data, wrote final write up

Ibsa Aliyi Usmane-collected and analyzed data, wrote the research paper and edited final write up

Jemal Nur-facilitated the work in workshop

Abdulahi Umer-prepared the prototype of the machine.

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