J Krishi Vigyan 2021, 10 (1) : 23-27 DOI : 10.5958/2349-4433.2021.00056.8

Comparative Performance of Chaff Cutter with Local *Machete Dao*

Temjennungsang and Longma Yanger Pongen

Krishi Vigan Kendra, Kohima, Nagaland 797109

ABSTRACT

Pig rearing is an important enterprise for the Tribal people of Kohima district. It is reared for its meat and is closely associated with their culture and tradition. The practice is to keep one or two pigs as backyard farming in-order to convert kitchen waste, industrial waste and green fodder into protein for human consumption. Freshly harvested green leaves from garden, forest and fields are chopped using *dao* which result in postural discomfort over time. The present study introduces manually operated chaff cutter with 2 blades and 3 blades in the district to overcome such constraints. The findings show that chaff cutter with 3 blades had the superiority over the other in various parameters. It had the capacity to cut 27.38 kg/hr over the local dao (19.35 kg/hr) showing an increase in output by 41.49 percent, operating cost for producing one quintal reduced from 280.77 to 196.30 and time spend to produce the same quantity was reduced by 43.75%. It eliminated complete pain from upper back, legs, neck and fingers, while reduced the severity of pain from the lower back, lower arms, shoulders, and hands.

Key Words: Chaff cutter, Dao, Tribal, Green fodder, Drudgery, backyard.

INTRODUCTION

Livestock plays an important role in Indian economy. About 20.5 million people in India depends upon livestock for their livelihood. It provides employment to about 8.8 percent of India's population, contributes 4.11 percent towards GDP growth and 25.6 percent towards total Agriculture GDP (Anonymous, 2019). As per 20th Livestock census the total pig population has decreased by 12 percent over previous 19th livestock census. However, piggery sector contributes 1.7 percent towards livestock population. In Nagaland, pig rearing is the most important enterprise as each household rear in small units interwoven with tribal culture and economic condition. The capability of pig to convert kitchen waste, industrial waste, green fodder and feeds into protein for human consumption has increase the demand for pork meat and the per capita consumption of meat to be the highest in the country. Small and Marginal tribal farmers of Kohima district usually feed the pigs with rice bran and freshly harvested green leaves which are cooked along with vegetables waste and other leafy materials before being fed (Talukdar *et al,* 2019). Green leaves such as Boehmeria platyphyllla, Collocasia *spp*, Elatosema disssectum *etc*. (Padmakumar *et al,* 2015) are collected from garden, fields and forest and cut into pieces to increase the consumption and palatability of feeds and reduce wastage. Chopping of leaves is time consuming and manually done using local machete called *'dao'*. It is used in sitting and squatting position which is physically demanding and increases the postural discomfort leading to back, shoulder, arms and wrist pain. This *dao* is also used for all agricultural operation (Singh and Devi, 2020). Keeping the above constraints faced by the tribal farmers on daily basis, it was necessary to introduce manually operated chaff cutter with two blades and three blades which can be conveniently handled by a person. Chaff cutter is a mechanical device for cutting young plants, into pieces before

Corresponding Author's Email: longmakvk@gmail.com

Table 1. Performance parameters of the cutting tools.

Year	Quantity of cuts (kg/hr)		Percentage Change of improved over local (%)	Quantity of cuts (kg/ hr)		Percentage Change of improved over local (%)
	Local	2 blades		Local	3 blades	
2019	17.35	14.80	-17.22	17.35	26.85	+54.75
2020	21.35	14.56	-46.63	21.35	27.91	+30.72
Mean	19.35	14.68	-31.81	19.35	27.38	+41.49

- Indicates % Decrease over local, + Indicates % Increase over local.

Table 2. Operating cost for cutting.

Year	Cutting cost (₹ Rs./q)		Percentage cost difference of improved over local (%)	Cutting cost (₹Rs./q)		Percentage cost difference of improved over local (%)
	Local	2 blades		Local	3 blades	
2019	309.79	363.17	+17.23	309.79	200.18	-54.75
2020	251.75	369.16	+46.63	251.75	192.58	-30.72
Mean	280.77	366.16	+30.41	280.77	196.38	-42.97

*Wage calculated @430/day. - Indicates % Decrease, + Indicates % Increase

Table 3. Time consumed for cutting.

Year	Time consumed (hr/q)		Percentage Time consume of improved over local (%)	Time consumed (hr/q)		Percentage Time consume of improved over local (%)
	Local	2 blades		Local	3 blades	
2019	7.6	9.0	+18.42	7.6	4.9	-55.10
2020	6.2	9.1	+46.77	6.2	4.7	-31.91
Mean	**6.9**	9.05	**+31.15**	**6.9**	4.8	**-43.75**

- Indicates % Decrease over local, + Indicates % Increase over local.

Table 4. Overall Discomfort rating during chopping.

Treatments	ODR*	MSP*	RPE*
Local *dao*	7.75	Severe pain in upper and lower back, lower arms, legs, necks, shoulders, hands and fingers.	Heavy
2 blade chaff cutter	4.5	Moderate to mild pain in shoulders, lower back, hands and arms	Moderately Light
3 blade chaff cutter	4.8	Moderate to mild pain in shoulders, hand, arms and lower back	Moderately Light

ODR*= mean value of Overall Discomfort Rating, MSP*=Musculo Skeletal Problem, RPE*=Rating of Perceived Exertion

mixing together with other forage and fed to pigs (Pongen *et al,* 2019).

.MATERIALS AND METHODS

The demonstration was conducted in Phesama and New Tesophenyu village during 2019 and 2020 under Kohima district of Nagaland. Twenty subjects were involved in the operation, having good experience in using conventional Local *dao* for preparing green fodder. Chaff cutter developed by Central Institute of Agricultural Engineering (CIAE) Bhopal was procured and distributed to the subjects. Green fodder leaves of tapioca, collocasia and sweet potato were collected in equal proportion from nearby fields and garden before the operation. The tools were assessed on allotted time period of 60 minutes, and the quantity of leaves cut were collected and weight after every 10 minutes interval. The following terms were used for performance assessment of the tools.

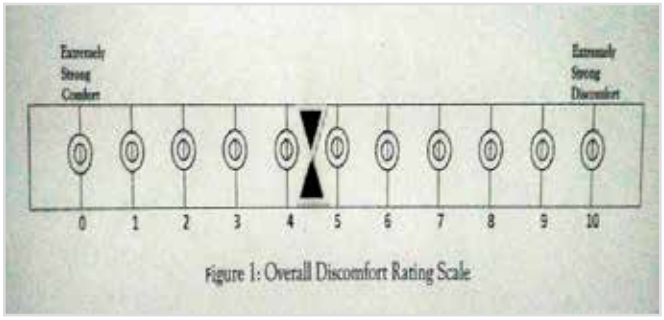

Figure 1: Overall Discomfort Rating Scale

Overall Discomfort Rating (ODR) scale technique developed by Corlett and Bishop (1976) was used for the assessment. The scale consisted of a 70 cm long graduated scale with its left marked as '0' and its extreme right as '10' that represented "Extremely strong Comfort" and "Extremely strong Discomfort" respectively. A sliding pointer was provided on the scale to indicate the discomfort level. After every performance the subjects were asked to give their overall discomfort rating on the scale by sliding the pointer (Fig 1). The overall discomfort ratings were averaged to get the mean rating. Musculo Skeletal Problems (MSP) experience by the subject during handling the tools was identified by indicating the pain in the body

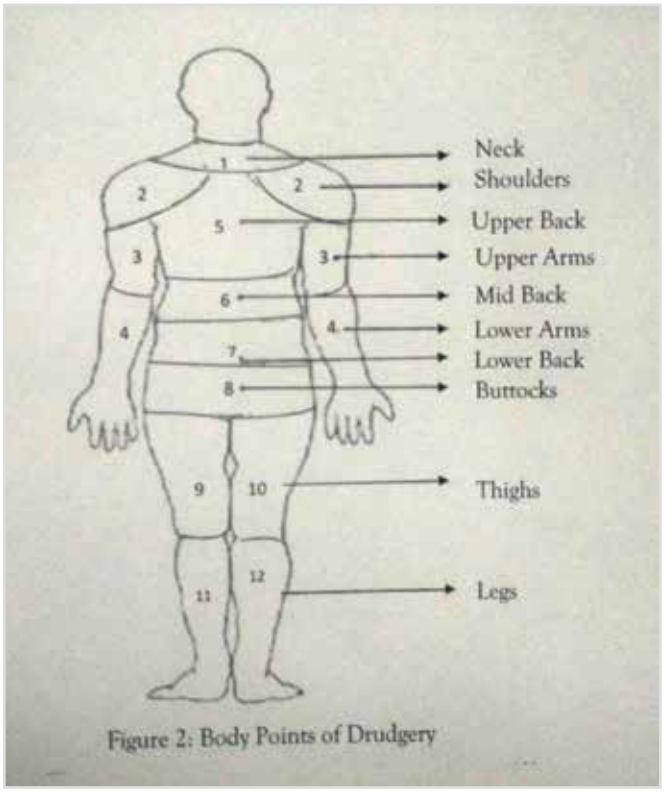

Figure 2: Body Points of Drudgery

map (Fig 2) after completion of every operation. Five point rating scale was used for recording the intensity of pain in various body parts *viz.,* 5, 4, 3, 2 and 1 for the intensity of pain as very severe, severe, moderate, mild and very mild, respectively. Rating of Perceived Exertion (RPE) was recorded in terms of pain and discomfort felt in body parts while performing the activity. Scale on perceived exertion developed by Varghese *et al* (1994) was used to assess the exertion. Attitude of the farmers towards the introduced tool were obtained through a questionnaire prepared for the purpose. They were asked to mark in favour of the best tool of their choice with respect to every satisfactory statement.

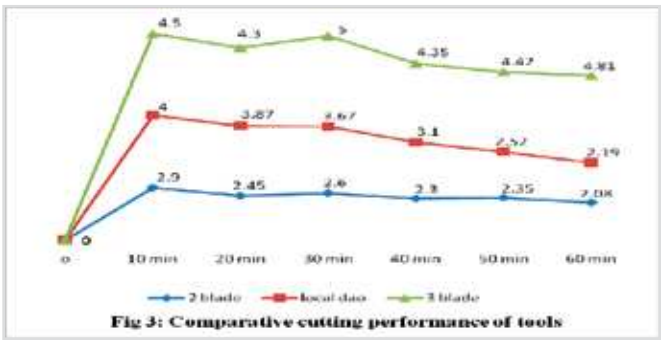

Fig 3: Comparative cutting performance of tools

Table 5. Attitude of farmers towards the tools. **(N=20)**

Sr. No	Statement	No of positive Responses		
		Local	2 blade	3 Blade
1.	Satisfaction with the tool for cutting purpose.	6(30.0)	5(25.0)	9(45.0)
2.	Satisfactory with the uniformity of size cut.	5(25.0)	5(25.0)	10(50.0)
3.	Satisfactory with the quality of material.	6(30.0)	5(25.0)	9(45.0)
4.	Satisfactory with ease of handling and operation.	8(40.0)	6(30.0)	6(30.0)
5.	Satisfactory with long hours of use.	4(20.0)	7(35.0)	9(45.0)
6.	Satisfactory with time saved.	13(65.0)	3(15.0)	4(20.0)
7.	Satisfactory with maintenance.	10(50.0)	5(25.0)	5(25.0)
8.	Satisfactory with drudgery reduction.	-	10(50.0)	10(50.0)
Mean score		5.2	4.6	6.2
Rank		II	III	I

(Figures in parenthesis denotes percentage)

RESULTS AND DISCUSSION

Freshly harvested green leaves were staged together at an ideal place for chopping. Three tools were used for its performance and compared for days. The tools were assessed for its capability to cut per hour and found that 3 blades chaff cutter on average had the capacity to cut 27.38 kg/hr over the local *dao* (19.35 kg/hr) showing an increase in cut by 41.49 per cent, while the capacity to cut the green plants in case of 2 blades (14.68kg/hr) was found to be less efficient as compared to the local *dao* (19.35kg/hr) on average with the same allotted time period (Table 1). A comparison of cutting between the three tools (Fig. 3) showed that 2 blades and 3 blades chaff cutter produce near consistent quantity of cuts throughout the assessment period, while the quantity produced by using local *dao* decreased gradually by 82.65% at end of assessment. It can be interpreted that local *dao* is handy for use only for a short time period and on continued use its efficiency decreases.

The operating cost (Table 2) for producing one quintal of green fodder was also tabulated for two different years. It found that the average cutting cost incurred by using 3 blades chaff cutter amounted to Rs.196/- which was the minimum expenditure among the three tools. The operating cost for the same tool during different years of 2019 and 2020 amounted to Rs 200/- and Rs 192/-, respectively. The average operating cost of local *dao* was estimated to be Rs 280.77 whereas it was Rs 366/- in case of chaff cutter with 2 blades.

The Time consumed to cut one quintal (Table 3) of green fodder was also recorded and found that maximum average time of 9.05 hr was taken by 2 blades chaff cutter followed by local *dao* (6.9 hr) and 3 blades chaff cutter (4.8 hr). Therefore, it can be assumed that 43.75% of precious time can be saved by using 3 blades chaff cutter to produce one quintal of green fodder.

Musculo Skeletal Problems

Musculo skeletal problems and posture exertion were obtained by asking the subject to express the pain felt in the body after chopping for hours with traditional *dao* and chaff cutter. It is shown (Table 4) that working in a particular posture for long hours cause fatigue and with the same working posture beyond certain time limit for years causes Musculo skeletal disorders in the body, thereby reducing the working efficiency of the subject. Working in squatting posture for long period might be the reason that almost all the subject reported

severe and moderate pain in upper and lower back, lower arms, legs, necks, shoulders, hand and fingers, so the subject perceived the task as a heavy one(Joshi *et al,* 2018). On the other hand, by using 2 blades chaff cutter pain in upper back, legs, neck and fingers disappeared, while moderate to mild pain was felt in the shoulders, lower back, hand and arms. Likewise using the chaff cutter with 3 blades moderate to light pain was felt in shoulders, hand, arms and lower back. Chaff cutter was made to operate in a raised plate-form either on a stool or table that eliminated the sitting posture and reduce some body movement and exertion. The rating of perceived exertion was also reported to be moderately light with the improved tools.

Farmers' attitude towards the tool were obtained at the end of the performance. It was observed (Table 5) that the subjects were satisfied with their own local *dao* in respect to maintenance of the tool (50%) and time saved for cutting (65%). On uniformity of fodder size cut it found that half of the respondent (50 %) was satisfied with the introduced 3 blades chaff cutter. However, with respect to drudgery reduction with the tool, the respondent favoured equally (50:50) to both the introduced chaff cutter while it was nil response in case of local *dao*. The positive responses obtained in favour of each tool can be summarized and concluded that the chaff cutter with 3 blades obtained more favours followed by local *dao* and chaff cutter with 2 blades and ranked in the order of 3blades >local dao>2 blades, respectively.

CONCLUSION

The study found that the introduced 3 blades chaff cutter proved to be superior in many parameters as compared to the smaller 2 blades chaff cutter and the local *dao.* Local *dao* proved to be efficient initially during the early part of the experiment however, by evening its efficiency to cut reduced, this shows drudgery and Musculo skeletal increases with constant use over time. However, cutting consistency was observed in 2 blades and 3 blades chaff cutter, though the cutting efficiency of 2 blades was not comparable to the local *dao*, it can still be promoted for use as it reduced the musculo skeletal pain in body parts. Therefore, the two introduced chaff cutters may be popularized for backyard farming purpose. However, for large scale production of green fodder machine operated chaff cutter may be promoted.

REFERENCES

Anonymouis (2019). 20th Livestock Census. Department of Animal Husbandry, Dairying and Fishery, Ministry of Agriculture and Farmer's Welfare, Government of India.

Corlett EN and Bishop R P (1976). A Technique for assessing postural discomfort. *Ergonomics* **19:**175-182

Joshi K, Pandey B M, Khulbe R K and Pattanayak A (2018). Occupational stress perceived by hill farmwomen of Jaunsar in Manual Chaff cutting. *Indian J Hill Farming* Sp. Issue. 108-111.

Padmakumar V, Haque N, Sirie R, Khate K, Deka R, Rutsa V and Solomon K (2015). *Availability and nutritional value of wild forages as feed for pigs and mithun in Nagaland, India.* ILRI Project Report. Nairobi, Kenya: International Livestock Research Institute (ILRI).

Pongen L Y, Temjennungsang Khekali Sema, Michael Pienyu K, Imtisenla, Zhiete and V Akashe Zhimomi (2019). Technology Resources for farmers of Kohima District. *Krishi Vigyan Kendra, Kohima Bulleting* Vol-II. Pp 30.

Singh L K and Devi S R (2020). Traditional tools and implements used in jhum agriculture in Nagaland. *J Krishi Vigyan* **8** (2) : 293-297.

Talukdar P, Samanta G and G Dhananjaya Rao (2019). Swine feeding and rearing practices in the Peren district of Nagaland, India. *J Entomol and Zool Stud* **7**(2): 561-565.

Varghese MA, Saha P N and Atreya N (1994). A rapid appraisal of occupational workload from a modified scale of perceived exertion. *Ergonomics* **37**(3), 485-491.

Received on 9/5/2021 *Accepted on 5/7/2021*